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JPRS-WST-85-004

30 January 1985

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West Europe Report

SCIENCE AND TECHNOLOGY

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JPRS-WST-85-004

30 January 1985

WEST EUROPE REPORT

SCIENCE AND TECHNOLOGY

CONTENTS

AEROSPACE

COMMERCIAL SPACE: EUROPE SHOULD HAVE INDEPENDENT STRATEGY

Huizen AARDE & KOSMOS in Dutch Nov/Dec 84 pp 518-522

/Article: "Doing Business in Space"/

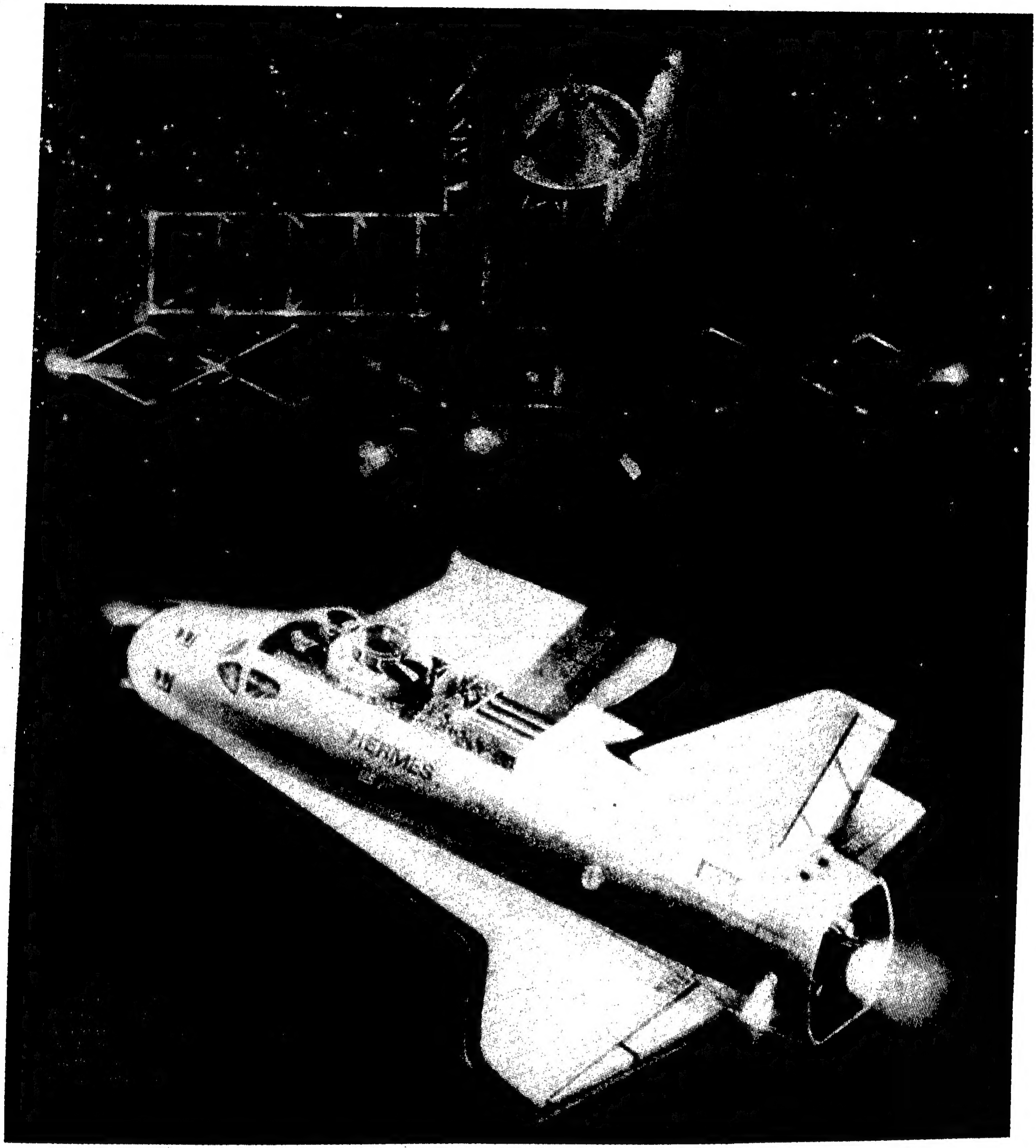
/Text/ Slowly but surely people will be doing business in space. The United States is taking the initiative in this, but Western Europe, which is happy to join in, is somewhat irritated by the way the United States is doing so. Possibly the Europeans can do better without the Americans.

SISO /possibly Science Information Services Organization/ code 659.85

For several years now many governments have been exclaiming that space is going to become commercial at last, by which they mean it will be possible to develop space without government money. Technical accomplishments, services, and new products are to make space profitable. The Dutch government too considers that grounds to build no new satellite of its own, but to join European cooperative projects (from ESA /European Space Agency/), an example of which is the colossal Olympus communications satellite (formerly known as L-Sat).

Just as 10 years ago in the United States computer firms shot out of the ground like toadstools, now space firms are doing the same. They have attractive names like Astrotech, Orbital Systems Corporation, Commercial Cargo Spacelines, Earth Observation Satellite Company, Starstruck Incorporated, and Transpace Carriers. Unlike the first computer companies, however, it takes a lot of money all at once to start up a space company, which is the reason that behind some of the new names there stand older air and space companies.

The talk about the commercialization of space could give the impression that no money is being made in space today. The opposite is true. Just think of the tremendous market for communications satellites. Also, business has been done for years now in data and photographs from Earth-observation satellites, and insurance companies have long done space-connected business. Still, when we think of the commercialization of space, we think of a number of other activities: selling launchings, renting out satellites, or making products in space that can be made there but not on Earth or can be made better there than on Earth.



For some time now the French have been studying a sort of small shuttle that would be launched with a powerful version of the Ariane. The first flight could occur in 1996. The shuttle is named Hermes and is shown here with a small space factory. Photograph: CNES /National Space Studies Center/.

It Has Started

A couple of examples. Arianespace, a Western European organization headquartered in France, sells launchings on Ariane rockets. Arianespace is made up of Western European companies and banks, including ABN [Algemene Bank Nederland] and Fokker from our country, and SABCA [Belgian Aeronautical Construction Company], ETCA [Central Technical Establishment for Armaments], and Fabrique Nationale in Belgium.

At its own expense, McDonnell Douglas, the U.S. aerospace firm, developed a small laboratory in which biological material can be purified on board the Space Shuttle. In the near future Orto [sic] Pharmaceutical Corporation will be using it to produce various drugs and hormone preparations.

Not long ago in the United States, for the first time a product was sold that could have been made only in space. The product was sets of polystyrene spheres, perfectly round and all almost exactly the same size: 1 micrometer (0.001 millimeter) and 10 micrometers. It is impossible to make perfectly round spheres of this size on Earth because of the force of gravity; they can be made in space. Each set contains around 15 million spheres.

The first to receive the spheres was the U.S. National Bureau of Standards, which in turn will sell the sets to large medical laboratories, among others. The laboratories will put the spheres in solution to produce a test liquid for equipment designed to count red blood cells. The spheres are also used to test filters and particle counters. In this case the seller was still NASA, but in the future a private company will be selling them. There already is one such company, Particle Technology Incorporated, founded by the inventor of the equipment in which the spheres were made (on board the Space Shuttle).

In Western Europe two firms are already prepared to sell their own photographs of the Earth. In France Spot Image has already been busy for 2 years looking for future clients for the French satellite SPOT, which is to be launched next year with an Ariane and is to provide better products than the U.S. Landsat. In West Germany, MBB [Messerschmitt Boelkow Bloehm] has built a small satellite on its own to go into space and return with the Space Shuttle. It is called SPAS and has already been tested on two Space Shuttle flights with considerable success. MBB has also tested its own Earth-observation camera, called MOMS [Multiple Orbits Multiple Satellite], on SPAS.

Problems with the Americans

In the meantime, a problem has arisen in connection with MOMS that may be characteristic of what we can expect in the future. Three firms started a joint venture last year to use MOMS commercially: MBB and the U.S. firms Communications Satellite Corporation and Stenbeck Reassurance Company. They called themselves SPARX. A while ago Communications Satellite backed off because of lack of confidence after closer consideration of the arrangement. MBB and Stenbeck went ahead, booked space in the meantime on a Space Shuttle flight for last August from NASA, and were looking for a new partner to take advantage of the more favorable terms granted U.S. firms.

Earlier this year NASA informed the partners that by law SPARX's photographs would have to be deposited in a U.S. government archive and would have to be available to the U.S. government. MBB replied that it was unacceptable to them to do business like that, and SPARX withdrew its load. The rule on the photographs is connected with the fact that NASA is a government body and operates on tax money. MBB is now investigating whether SPAS can be converted to be launched with the Ariane. Just to be safe, a launch has been reserved for 1987.

The vicissitudes of SPARX demonstrate that legal problems can arise in dealings with NASA. Other problems can arise from the restrictions on exports of high technology that have been announced by the Reagan Administration. That could present obstacles in the use of the U.S. space station, which is to be completed in 1992. At the moment the Americans are looking for Western European and Japanese participation in the project.

Experience with the Spacelab has taught Western Europe that if they are to participate in the space station, they must set clear conditions and demand tough agreements. The space station will be an important site for commercial activity in the 1990's. Hence everybody would like to be a part of it on principle.

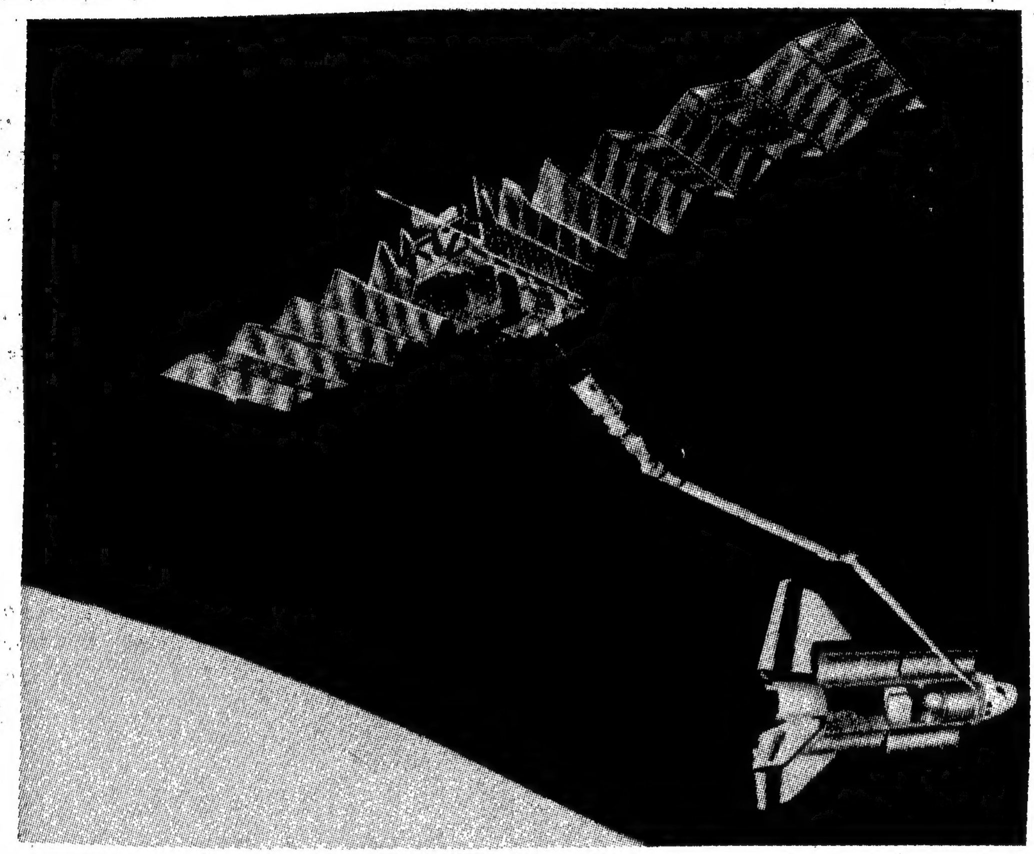
Europe Goes Ahead on Its Own

The problems just mentioned have strengthened the Western Europeans in the idea that they ought to set up their own projects too. Thus there is a plan ripening to participate in the space station, but to do so with a section that would operate as independently as possible and be built entirely by the Europeans. That would be named Columbus and is based on Spacelab technology. The plan is currently being worked out by MBB and Aeritalia.

SPAS is already operational. It is unique, but in the future will have company from a second Western European space platform, the Eureca, a project from ESA. In their present form both SPAS and Eureca can only be put into space (and brought back again) with the Space Shuttle. Studies are presently under way on the possibility of having SPAS and Eureca couple with one another. SPAS and Eureca are particularly well suited for studying the behavior of materials in weightlessness and for producing new alloys. Variations for Earth observation are also under study.

In the meantime the Ariane has become a very strong commercial asset for Western Europe. On 4 August the first launch of a more powerful version of the Ariane came off perfectly. Versions with much greater power yet, and thus able to carry heavier loads at one time, are under development.

Vehicles are being developed in Western Europe to transport loads in orbit around the Earth. The Italians are working on an auxiliary rocket called the IRIS that is comparable to the auxiliary rockets the Americans use with their Shuttle program. In West Germany they are studying a sort of space transport able to carry cargoes through space (see AARDE & KOSMOS 3/1984).



ESA is developing a space platform due to go into space for the first time at the end of 1987. The platform is named Eureca and can operate independently in space for 6 months. Photograph: ESA.

Undoubtedly the most spectacular of all the European ideas is the Hermes, a sort of small shuttle. This is a French idea that has been under study for years and is very gradually moving toward its final form. According to the latest ideas, the Hermes would be 15-18 meters long with a wingspan of 10 meters, a crew of four, and a cargo-carrying capacity of 4.9 tons. It would be able to fly for the first time in 1996, launched with an Ariane-5 and gliding back to Earth, just like the U.S. Shuttle. The French are investing so much effort in this project at the moment that even existing plans for small automatic space factories and a small station have been put on the back burner. At present Western Europe has all the knowledge and skill necessary to play an independent role in space. It appears that under French and West German leadership it also intends to play that role.

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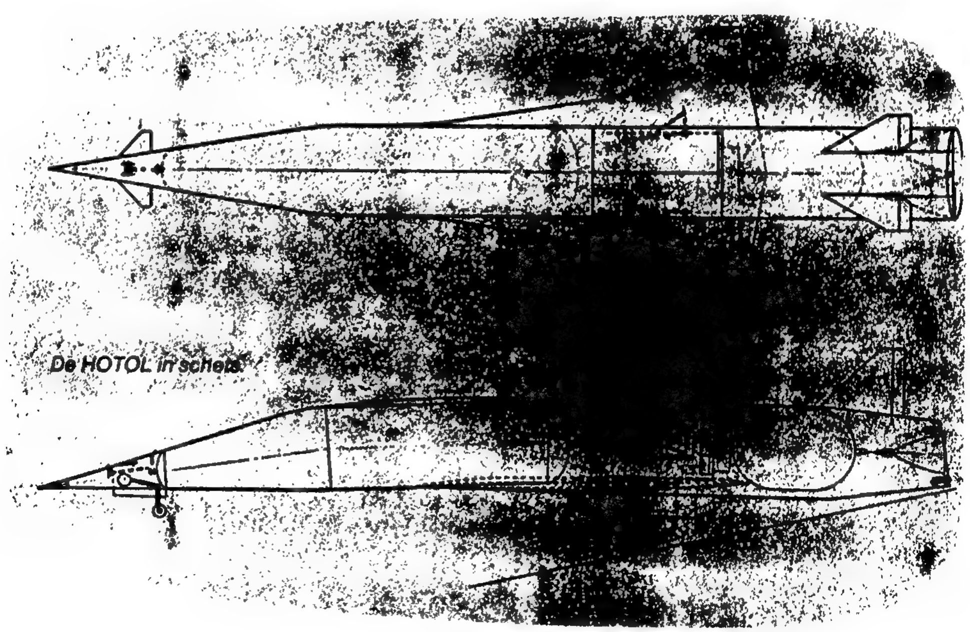
AEROSPACE

BRITISH AEROSPACE STUDIES 'HOTOL' SATELLITE LAUNCHER

Huizen AARDE & KOSMOS in Dutch Nov/Dec 84 p 536

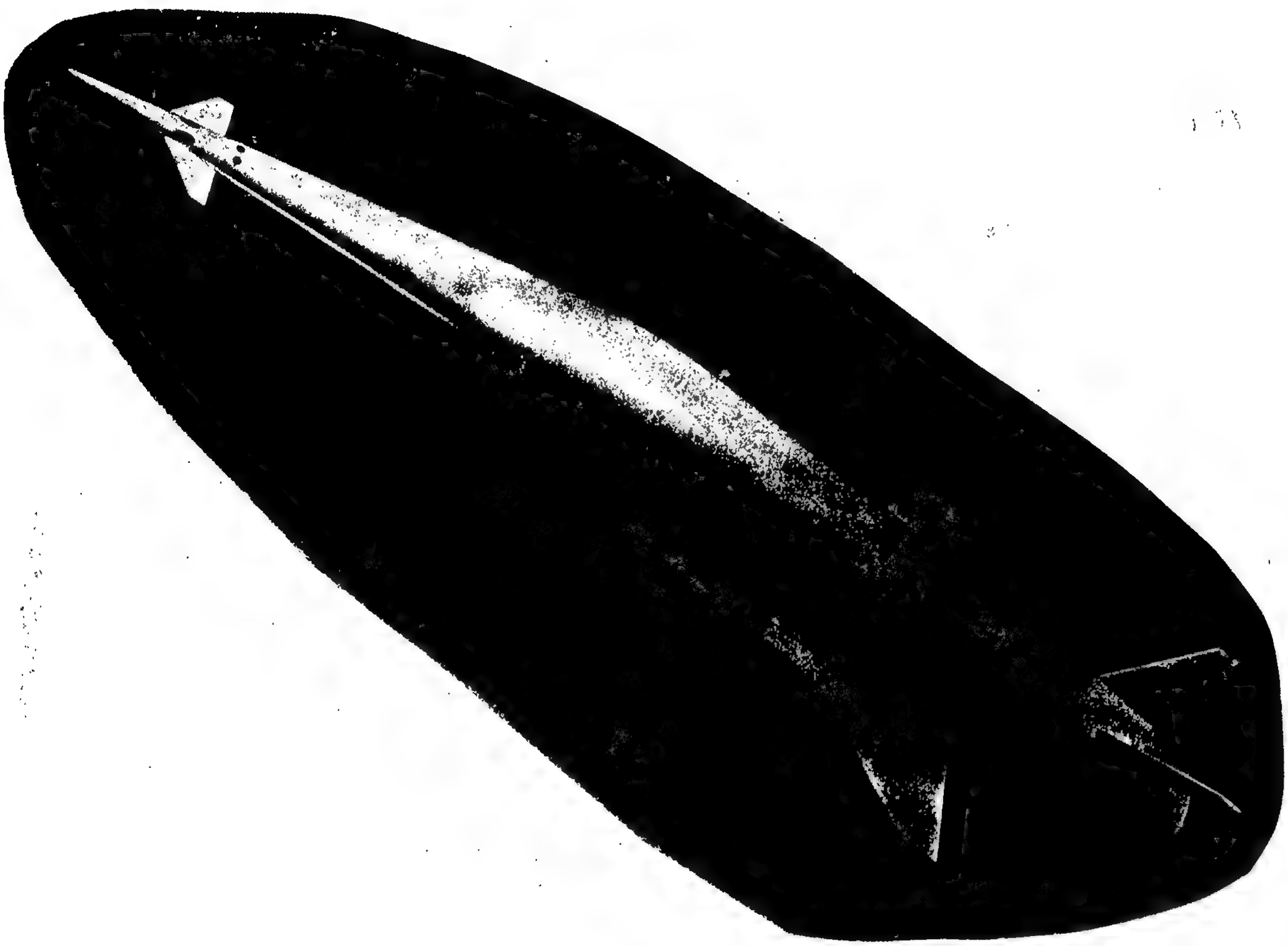
[Article: "British Study Spacecraft"]

[Text] The Space Shuttle is a space station as well as a rocket, which has its disadvantages. The Ariane is a rocket all the parts of which can only be used once. It must be possible to arrange things better. The British firm



Sketch of HOTOL

A model of HOTOL. Note the small maneuver wings at the nose. The black markings are not portholes; they are places for sensors, radar, etc.



British Aerospace is studying a solution called HOTOL, Horizontal Take-off-and-Land Satellite Launcher. HOTOL was presented to the public for the first time last August.

According to the British study, HOTOL takes off from an existing airfield like a Concorde, flies into a low orbit around the earth, leaves its cargo there (with a total weight of 4000-7000 kilograms), and returns to where it started like an airplane. Thus HOTOL needs both a normal jet engine and a rocket engine. The only thing that British Aerospace would say about the engine is that it is a "breathing" engine, one that functions as a jet inside the atmosphere and as a rocket outside the atmosphere.

Unlike the Space Shuttle, HOTOL can be steered during its return flight too. According to present plans, it is to be unmanned, with a length of 54.37 meters and a wingspan of 17.01 meters. We will come back to this project in more detail in the next issue of AARDE & KOSMOS.

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CSO: 3698/145

VAN DOORNE'S TRANSMISSION, CVT MAKER, FACES BANKRUPTCY

Reasons for Financial Problems

Rotterdam NRC HANDELSBLAD in Dutch 6 Nov 84 p 13

[Editorial by Dick Wittenberg: "Van Doorne's Transmission"]

[Text] Does bankruptcy really mean the definitive end of the Tilburg company, Van Doorne's Transmission [VDT]? Or is it a clever trick to get rid of the difficult shareholder Borg Warner through the device of a dying company? The answer to these questions is not really important. In both cases the high level knowledge will completely or partly disappear from the Netherlands. The only way to save a unique product for the Netherlands is by keeping VDT on its feet.

Actually it is absurd that there is even talk of bankruptcy. The company has developed a revolutionary automatic gear box which is seen as the egg of Columbus by the automobile industry as a whole. The company has orders for more than 100 million guilders from such renowned corporations as Ford, General Motors, Subaru and Fiat. Only a few tens of millions of guilders are needed to give VDT a chance at the gold. Precious little when compared to the 100 million guilders which have already been sunk into the company. More crumbs when you think about how much money VDT could earn in the near future thanks to its monopoly position.

And yet, the American shareholder Borg Warner obstinately continues to block a capital injection. One can only guess at the motives. Part of it may be the fact that Borg Warner holds an ironclad position in the area of conventional automatic machines. Or perhaps what is important is that the Americans themselves are in the process of developing a new automatic machine.

In any case, the other shareholders -- Volvo Car, Fiat and the Dutch state -- did not succeed in breaking Borg Warner's veto. For a long time, perhaps too long, the Dutch government stayed out of the turmoil of battle. Until last week when the National Investment Bank decided to claim all the patents. A right which the bank has had since last year because of the financial default of VDT. "A precautionary measure," said a spokesman for the Ministry of Economic Affairs. "To keep the knowledge in the Netherlands." It is ironic that with that well-intentioned action the government has actually sounded the end of VDT. As a matter of fact, the action by the National Investment Bank was a direct reason for the Amro Bank to turn off the money tap immediately.

As a result, the existence of VDT is now acutely threatened. In reaction, the Ministry of Economic Affairs has announced that senior official Lelieveld will go on an emergency mission to America next week. He has to try to get Borg Warner to change its position.

"Far too late," said A. Verdijsseldonk of the Industrial Union FNV [Netherlands Trade Unions Federation]. He noted that the crucial meeting of shareholders is set for Thursday. To further delay a decision would mean that mass production, which actually should have started on 1 July 1985, will be delayed for at least 3 months.

Verdijsseldonk expects that by then the automobile corporations will have lost interest.

According to the unions, Director Van Ham told the personnel yesterday that they are looking for structures to continue the enterprise after bankruptcy anyhow. Such a statement seems to point to the dying company device. Bankruptcy is at first sight an adequate way to get rid of debts and difficult shareholders. New money lenders are already waiting in the wings. But yet, the risks are far too great. Bankruptcy takes time and there is a good chance that the clients will run away then. Furthermore, there is a very poisonous snake hiding in the grass.

With bankruptcy either Borg Warner or Fiat or Volvo Car can claim a licence after half a year. In that case the knowledge would not remain exclusively in the Netherlands. A spokesman for the Ministry of Economic Affairs said firmly: "We are not seeking bankruptcy. We are not seeking to set up a dying company device. We want to preserve the knowledge for the Netherlands." Then they will have to act quickly.

Advantages of Van Doorne's CVT

Rotterdam NRC HANDELSBLAD in Dutch 6 Nov 84 p 13

[Article by Wiebe Draijer, Jr.: "The Transmatic: a Technical Handstand -- Future of Van Doorne's Clever Kid Should Be Rosier"]

[Excerpts] Rotterdam, 6 November -- "The Transmatic (CVT [Continuously Variable Transmission]) is cheaper, smaller and of a simpler design than all existing automatic and continuously variable transmissions. Its energy loss is lower and it lasts longer," said Director J. van Ham of Van Doorne's Transmission, a company which is experiencing difficulties.

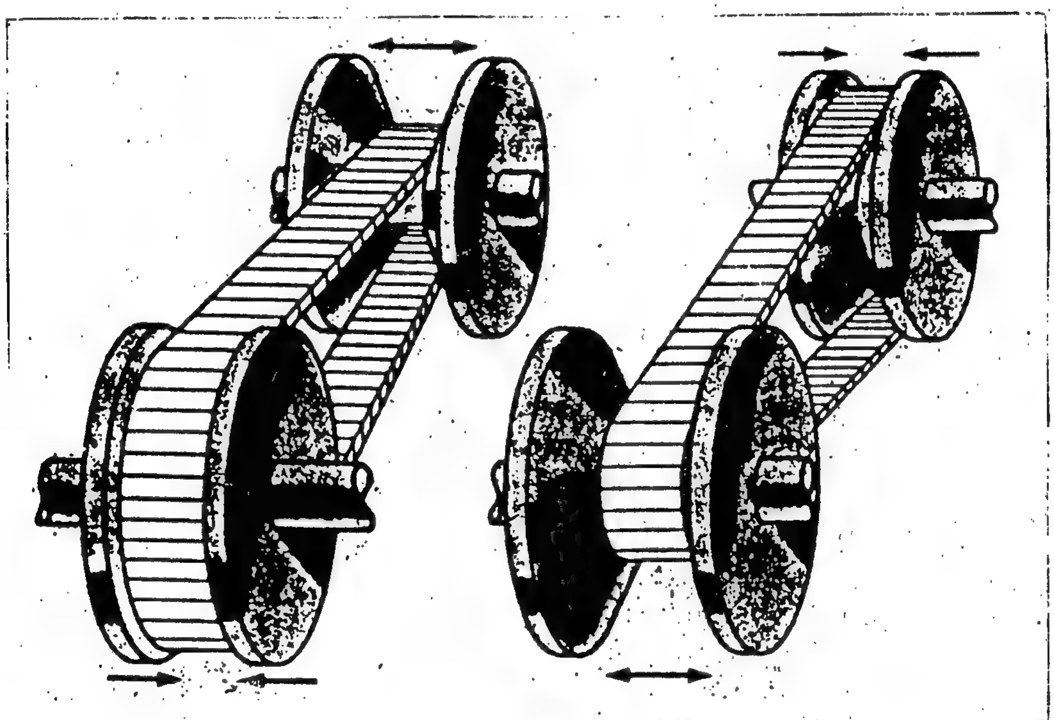
It is only when you take off your commercial glasses and look at the clever kid with a somewhat more technical frame that it becomes apparent how much ingenuity is involved in the small automatic machine. It is not without reason that automobile corporations like General Motors, Fiat, Ford and Subaru have accepted the CVT as the automatic gear box of the future. However, the exceptional automatic machine has more applications than just for private cars.

The basic idea of the CVT, of Transmatic, is not new. In 1879 already, the American H.C. Spaulding patented a variable drive without stages. The device consisted of a belt which was stretched between two conical belt pulleys.

Variomatic

It was only in 1958 that Spaulding's idea reappeared. The Dutchman Dr H.J. van Doorne used it to develop the first fully automatic transmission, better known as the "Variomatic." The shifting mechanism in this automatic machine is a rubber belt, stretched between two conical pulleys. The pulleys each consisted of two conical covers lying against each other.

New System



Schematic representation of the principle of the continuously variable transmission: in the front the pulley connected to the engine, in the back the pulley connected to the wheel drive. The V form of the pulleys makes a change in circumference possible. In the left situation the CVT is in high gear. By pushing the engine-pulley apart and the wheel-pulley closer together the shift relationship gradually shifts to low gear. (On the right.)

In this new continuously variable transmission all the problems encountered by Variomatic in its use have been solved. The Transmatic is small and consequently can be built into all existing types of cars. Furthermore, it is capable of handling much greater engine power and numbers of revolutions than its predecessor could.

The drive belt in the Transmatic consists of a strong metal strip with a large number of small metal plates slipped onto it transversely. These small plates, the links, provide the shifting. The belt is intended to keep the plates in place when idle.

When the engine activates the first pulley, the small plates between the two revolving pulleys are pushed together. This produces a kind of metal rod which shifts the power of the engine via the first pulley to the second pulley. On the side of the pulleys where the belt is not pushing, the links have some play on the metal belt. The small plates are beveled off on one side so that they are able to go around the pulley. The belt with links has the same flexibility as the old rubber belt.

Because the links put pressure on each other instead of pulling each other, the belt can shift much more power than the rubber belt. This increases the number of possible applications because now trucks and machinery are also eligible for a CVT.

Other advantages of the push principle are, among others, greater resistance to wear and the presence of much less friction in shifting from engine to wheels.

Economical Automatic Machine

The change from a pull to a push belt is not the only thing that makes the Transmatic so much more attractive than the Variomatic. A new hydraulic control mechanism was developed for the clever kid.

Through an ingenious combination of pistons and valves, at every engine speed the Transmatic chooses the optimal shift relationship in the pulleys. The hydraulic system turns the CVT into a super-economical automatic machine. The fuel consumption is nearly 20 percent below that of existing automatic machines and approaches that of a manual transmission car.

Extensive testing of cars with a CVT has shown that the driving characteristics do not change compared to manual transmission cars of the same type. On the contrary, compared to driving with an ordinary automatic, driving with a CVT car is called sporty.

Optimal

E. Hendriks, head of development at Van Doorne's Transmission, said: "When accelerating with full throttle the CVT chooses an optimal shift relationship. Therefore, acceleration from a standstill is comparable to an ordinary car. It becomes fun only when you accelerate further. Where a manual transmission

car with an inefficient engine speed has to go to the extreme and lose a great deal of time, a car with CVT will inevitably run ahead. By means of various adjustments you can program any desired driving style, from very economical to sporty," said Hendriks.

Asked whether because of this possibility the CVT is not particularly well suited for Formula I racing, Hendriks answered: "As a matter of fact, that would be a first rate application for the Transmatic. By being able to shift as quickly as possible to the highest possible number of revolutions of an engine and from there to alter the shift relationships, would undoubtedly make you faster than the others. It is true that the hydraulic system of the CVT would then have to be adjusted very precisely for that application. It is clear that a great deal of time is lost by shifting and especially by uneconomical shifting."

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CSO: 3698/103

JPRS-WST-85-004
30 JANUARY 1985

LE FIGARO ON WORLDWIDE STRUGGLE FOR AUTOMOBILE MARKETS

Lack of European Unity

[Paris LE FIGARO in French 10 Dec 84 p IV]

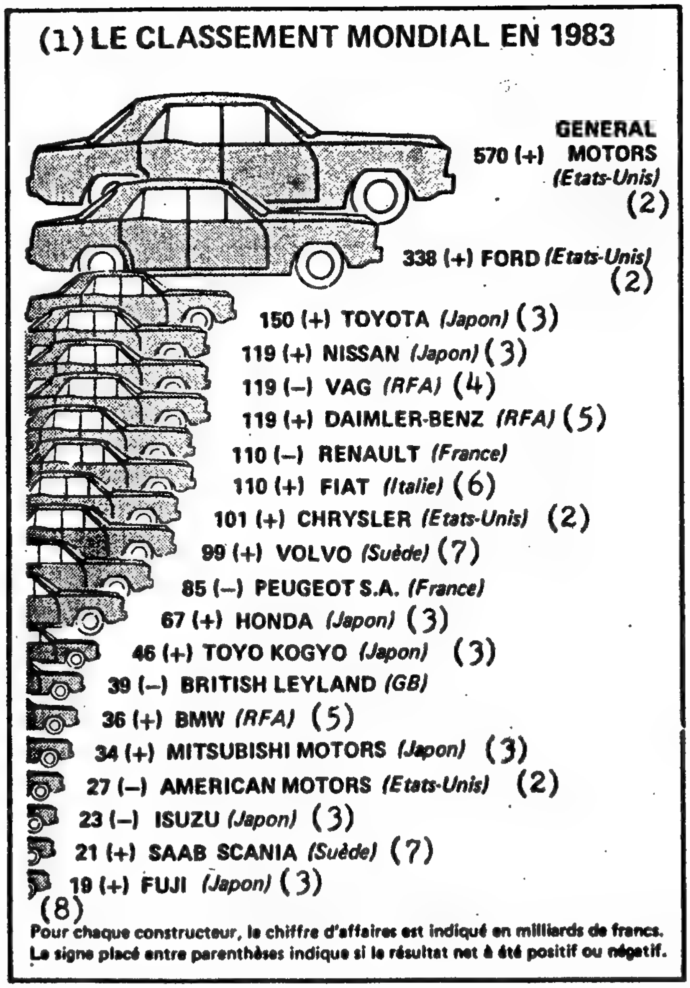
[Article by Daniel Tacet: Automobiles: "The New World War"]

[Text] The automotive world war is taking on a new direction. Its objective: to define a new world car concept, adaptable like an erector set according to the tastes of different countries. Europe is having a hard time standing up to the Americans and the Japanese because of the lack of European unity.

Beyond the specific problems which most European auto manufacturers are experiencing, an incredible arm wrestling match is about to begin for the conquest of the worldwide market. Each year Europe is losing ground; from now on the problem is to find out where the bottom line will be. The stake is crucial. It is political, economic and social.

The major manufacturer and the major world exporter during the golden age of growth, the European auto industry has, in 10 years, lost its position of leadership. Because it did not manage to carry out its retooling before the others. This is a historical error which may prove fatal to it at least for the intermediate term. No doubt it will return to the top of the worldwide ranking; but, while worldwide production has increased by 70 percent since 1970, the number of units produced in EEC has been virtually stagnant since that date. And at the same time that Europeans were increasing their purchase of vehicles from outside the EEC tenfold, European exports to the world market were decreasing by 10 percent inspite of a measurable recovery in 1983.

What have been the consequences? Loss of numerous jobs with manufacturers, not due solely to the imperatives of reorganization, and also jobs with supplies.



Key:

1. World Ranking in 1983
2. United States
3. Japan
4. Volkswagen (FRG)
5. FRG
6. Italy
7. Sweden
8. For each manufacturer, revenue is expressed in billions of francs. The sign in parentheses indicates whether the net result was positive or negative.

Calls to Arms

The battle for the conquest of the worldwide automobile market will become more and more severe, and probably not to the EEC's advantage since each country will stubbornly prefer to maintain its own positions.

Calls to arms are sounded with regularity by the experts. Giovanni Agnelli, head of a company--Fiat--which has managed to retake its positions to the point of becoming the leader in European production, continues very persistently to preach unity: "It is necessary, once and for all, to renounce nationalisms and to believe in the European system, not just in words, but also in actions. We have to be part of the train of economic growth without viewing ourselves as a boxcar coupled to American and Japanese locomotives. We have the technical capability, but right now we lack a coherent Common Market policy, a will to resolve our problems through a unique common denominator."*

This clearly means that it is indispensable to set up a single jurisdiction for all, facilitating the organization of large European enterprises capable of forming the kinds of associations which can effect standardizations and savings on a truly efficient scale. This would be for the intermediate term. Right now, the automobile price war throughout Europe will probably not benefit the manufacturers. It would be extremely dangerous to confront this competition with discounts which are not justified by a simultaneous reduction in production costs.

Here are two real examples of the lack of solidarity among European manufacturers in facing the peril which threatens all of them.

After having imitated the Americans immediately following the war and then passing them by, the European auto industry now finds itself trailing these same Americans, who were very quick to recognize the Japanese threat. To be sure, measures were taken, country by country, to counter the offensive of the Japanese manufacturers in Europe. But there is no unity at all. There is no comparison, in fact, between Belgium, which is opening its doors wide to Japanese manufacturers, and Italy, which, for 20 years now, has been limiting imports to 2,000 vehicles per year. In France, Japanese penetration is limited to 30 percent. It must be admitted that, if such measures had not been taken, French manufacturers would find themselves in an even more uncomfortable situation than they are now in.

Overall, the superiority of the Japanese auto industry is overwhelming. It has managed to adapt its models to all tastes and all clienteles, concentrating at the same time on maximal productivity. Thus, it is estimated that producing the same car would cost $6,000 in the United States, $5,000 in Europe and only $4,000 in Japan.

The agreement reached 15 February 1983 between Toyota and General Motors for joint manufacture of a vehicle sounded the alarm. Aside from the fact that it shifts the center of gravity of the business world from the Atlantic to the Pacific, this agreement demonstrates the desire of the two worldwide automobile giants to preserve their supremacy. The worldcar, imagined by so many futurists, thus seems to be rapidly approaching reality. The problem is that it will not be European....

* LE FIGARO MAGAZINE 1 December.

Japanese Strategy

[Paris LE FIGARO in French 10 Dec 84 p IV]

[Article: "Japan: The Second Wager"]

[Text] Giving priority to coproduction with foreign companies is the solution chosen by Japanese manufacturers to dominate world markets more effectively. It has a good chance for success in Europe.

Japan's first wager was to conquer the world--no more, no less--by direct sales out of Japan. For the long term that was impossible: the western countries endowed with national industries were quick to put up barriers. Then the Japanese knack for quick adaptation to new situations launched a new challenge: priority was given, from then on, to coproduction with foreigners. Since it is impossible for them to take a country by storming it, they might as well circumvent the problem and make agreements with domestic manufacturers.

This strategy has netted spectacular results in the United States and has a good chance to succeed in Europe. Look at British Leyland--saved from bankruptcy--by Honda.

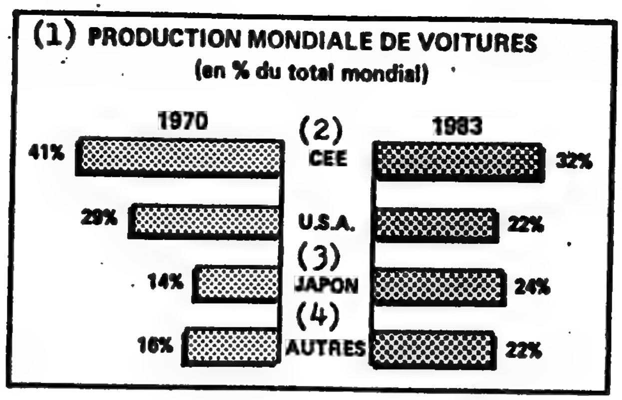
The era when Japanese manufacturers could produce vehicles entirely at home and export them with impunity is over. And they have decided to dilute their sake with water.

Trade Offensive

Japanese management began signing many agreements, almost without flinching, where they commit themselves to manufacture all or part of the vehicles in collaboration with European or American firms with some of them even providing for foreign installation of components. In this connection, whenwill there be a Peugeot or Renault factory in Tokyo? Like it or not, Japanese manufacturers no longer have any choice but to adapt to the new conditions of the market.

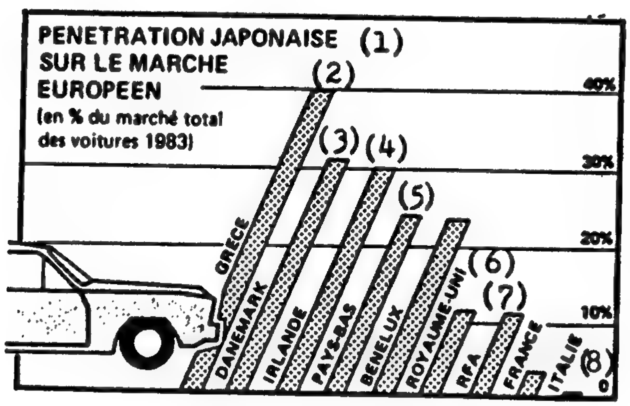
With the pragmatism for which they are famous, the Japanese decided to rejoin the ranks--to avoid death within 10 years--for no national manufacturer will be able to survive without a worldwide policy.

Since 1970, the Japanese auto industry has carried out an extraordinary offensive throughout the world: anywhere they could hope to sell, even if it was only one single car--in the Near East, in black Africa, which is forsaking French vehicles little by little in favor of models coming from the empire of the rising sun. In 15 years, thanks to this all-out strategy, Japan has more than doubled its exports. It did not take long to snatch from the EEC the lead in the world market which it still held until 1975. Beginning then, out of every 10 exported cars in the world, only a little more than 2 still come from European factories, while nearly 5 are Japanese.



Key:

1. Worldwide Automobile Production (% of world total)
2. EEC
3. Japan
4. Others



Key:

1. Japanese Penetration into the European Market
   (% of total 1983 vehicle market)
2. Greece
3. Denmark
4. Ireland
5. Netherlands
6. United Kingdom
7. FRG
8. Italy

The trade challenge with which Japan thus confronts its rivals--in Europe as well as in the United States--demonstrates clearly the fact that the weakening of the European automotive sector cannot be explained merely in terms of the general economic crisis and successive gasoline shortages. Of course, European and world demand for cars has slowed, but the problem of the European industry--compared to that of Japan--is more one of delayed adaptation in the face of the most significant transformation in automotive history.

Anticipated Evolution

Some figures: In 1952, out of 130,000 cars in use in Japan, 100,000 were of foreign origin; in 1984, Japan will produce 8 million cars, of which more than half will be exported. In 20 years, Japan has increased its annual productivity in the automotive sector twice as fast as the Europeans and 4 times as fast as the Americans.

What is the outlook for development? According to a recent report on automation for the Senate, "The MITI [Ministry of International Trade and Industry] has just established a new industrial policy for the automotive sector which provides for acceleration of automation of the production process such that in 5 years productivity per employee should be doubled."

Furthermore, various sources report Toyota's ordering of 720 welding robots which would indicate total automation of its factories by the end of 1985.

These figures refer only to production units installed in Japan. What will be the case for the affiliates established throughout the world? There is no doubt that the redeployment of the Japanese industry will take the form of an internationalization of automotive production and assembly activities and of an investment policy reaching outside the sector. In fact, the financial assets of Japanese companies are such that their total reinvestment in the auto industry is ruled out in any case.

That is why Nissan is involved in the manufacture of outboard motors and in mass production of complete boats while Toyota, already engaged in banking, is now manufacturing prefabricated homes on the assembly lines.

While continuing to represent a major threat to the American auto industry, the Japanese "dynamic" is even more menacing to an eternally divided Europe.

Outlook for Future

[Paris LE FIGARO in French 10 Dec 84 p IV]

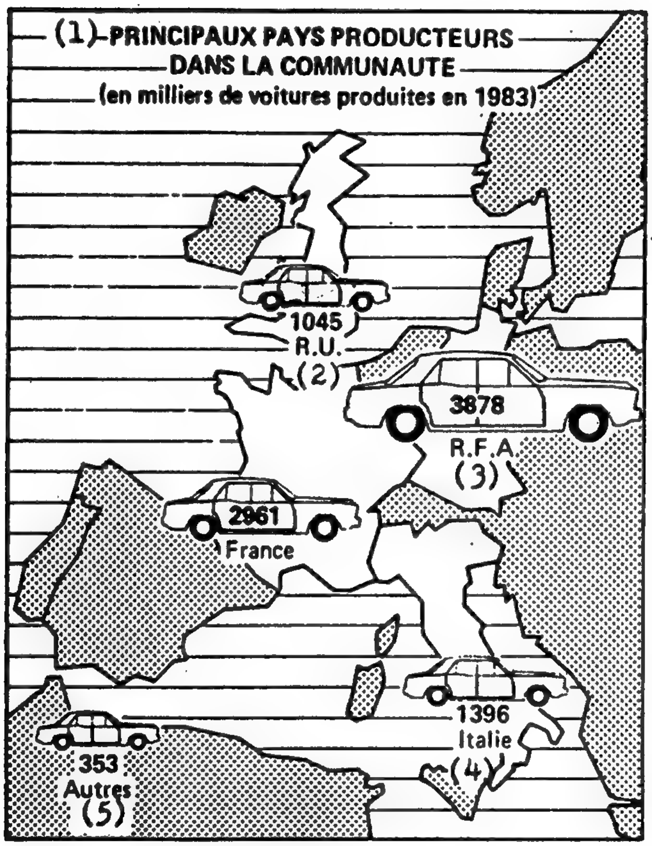
[Text] Yesterday's priorities--production capacity and safety--have given way to a new imperative: confronting the reduction in volume. This implies improvement of the rate of profitability.

Consume less and less. For Europeans that is the most significant technological bet. The problem is to figure out whether they are right. This is a

result of the several gasoline shortages which demonstrated the excessive cost of motor fuel.

In 25 year, automotive technology has undergone a profound transformation resulting in the movement from "individual transportation" to "mass traffic."

In 1957, 48 automobiles were on the roads for every 1,000 inhabitants. Today, that number has exploded until it has reached 400 vehicles per 1,000 inhabitants in the FRG for example. As far as vehicular density is concerned, Germany is number one in Europe, a position recaptured from France in 1980.



Key:

1. Major EEC Manufacturing Countries
   (in thousands of vehicles produced in 1983)
2. United Kingdom
3. FRG
4. Italy
5. Others

Energy conservation is a factor, but there is also a new preoccupation with environmental preservation. Following a campaign orchestrated in the FRG by the "Greens," the EEC has fixed 1989 as the date after which the use of unleaded gasoline will be mandatory. The delay is intended to give industry time to make the necessary investments.

Diesel Upsurge

Less and less expensive. Every European automobile company has a prototype of what is to be an economical car. Tomorrow's autos will be much more economical for the same or an only slightly higher price.

Improvements in this direction have already been made on the level of the engine and the transmission, in aerodynamics and construction (lightness). A new decrease in fuel consumption, reduction of noxious gas emissions and an increase in comfort are among the acknowledged goals for the entire vehicle, especially for the engine.

The decrease in fuel consumption will play a predominant role because it represents a major sales incentive.

The upsurge in diesel in recent years is a convincing example of this. There is also research into new materials--with two key words: plastics and electronics. For all future automobile bodies, it will be a matter of chosing, given equal characteristics, the most lightweight materials possible.

There will, in fact, be little surprise and no revolution. The automobile of the year 2000, European, American or Japanese, will be relatively similar to that of today. All the experts are convinced of that. The automobile will evolve, as always, by small touches, by timely and imperceptible innovations.

Let's not forget. In the sixties, all anybody talked about was the rotary engine: more efficiency, less wear. Where is it now? Automobile engines will deliberately remain traditional.

This relative technological stagnation proves, if there is any need for proof, that the worldwide battle for conquest of the automotive sector will take place on the level of sales and marketing. It will therefore be necessary to continually reduce production costs, something which the Europeans, for now, are not managing to do, if you compare their situation with that of the Japanese in particular.

With regard to industrial capacity and sales force, it is likely that the Americans will continue to manufacture in Europe even as the the Japanese, through "marriages," improve their position in Europe.

At the same time, there will be few European manufacturers who will dare to venture into the American market. Volkswagen and Fiat have tried it; they failed. Renault remains, through the intermediary of its American Motors network.

This is an operation severely criticized particularly by workers unions. It may become clear that the American option of the administration is all important. Once again, look at the Japanese experiences in the largest market in the world.

This beachhead will have had at least one merit, that of showing Europeans what could be an important marketing strategy for a long time... and the conquest of a market which is already saturated.

No More Lead by 1989

Subject to the judgement of the European Parliament, the ten states of the EEC are supposed to offer motorists unleaded gasoline starting on 1 July 1989. The favorable judgement from the European Parliament seems to have come now.

Last Friday's council meeting had a full agenda, thus, in addition to lead in gasoline, it dealt with, among other things, air quality standards for nitrogen dioxides and emission standards of internal combustion vehicles, that is for oxides of nitrogen, unburned hydrocarbons and carbon monoxide. A first proposal concluded that the EEC should apply the standards in force in the United States and Japan, but this approach does not really suit the market in Europe.

A second proposal wanted the American standards to be applied only to vehicles conforming to these standards, that is, to vehicles with large displacement engines, and for us to wait for technical developments which might apply to vehicles with small displacement engines.

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GERMAN SUPPORT FOR BIOTECH INDUSTRY EXPANDING

Duesseldorf HANDELSBLATT in German 22 Oct 84 p 16

[Excerpt] Another gene center was opened at the beginning of May 1984 in Munich. After Cologne and Heidelberg, it is the third focal point in the FRG in which there is to be basic and applied research in gene technology. What is new is that scientists from the Max Planck Society and the university will work together here and will be supported by a nonprofit association. Working groups will be established at the Max Planck institutes in Martinsried and in three departments of the Ludwig Maximilian University in Munich. Prof Ernst-Ludwig Winnacker is director of the Munich gene center. On the occasion of the opening of the research focal point "Bases and Applications of Gene Technology," he read the paper that is published below.

Interdisciplinary Science

Here it is not a matter, as we have just seen, of recognizing a soluble foreign object but a foreign cell. The result is questions concerning cell-cell recognition and the structure of cell surfaces. Also, an organism suffers fatigue in recognizing its own or foreign cell surfaces, a phenomenon generally known but not understood under the key word rheumatism. A similar question but one leading to completely different goals is presented to us by the nervous system, for which a working group under Prof Thoenen is seeking to find out about certain aspects of its control mechanism by using up-to-date methods of tene technology. Finally, it is no secret that we know by no means everything even in the area of apparently so simple organisms as the unicellular microorganisms. Just in the last few years, a class of microorganisms--the so-called archaebacteria--was discovered. They live in extreme habitats such as extremely salty seas like the Dead Sea or in seething volcanic springs on the ocean floor. To live there, they have adapted in special ways, with membranes that very efficiently convert sunlight directly into energy or with enzymes that withstand temperatures beyond 100 degrees Celsius. To make these organisms--that are also of interest for industrial applications--available to gene technology is, among other things, the job of colleagues Boeck, Oesterhelt and Zillig. In addition to these and other still unnamed projects that are now to be promoted, we also continually receive inquiries from other

institutes--in animal breeding, forestry and genetics, for example--all of which we naturally will consider wherever possible. Here it is abundantly clear the extent to which gene technology is an interdisciplinary science that goes beyond narrow specialization.

With the establishment of this focal point for research, we are now giving consideration to these developments in research, but we must also do that in theory.

The university is therefore planning to construct a biological laboratory in Munich patterned after the famous Harvard biological laboratories. Here we want to try to finally leave behind the narrow limits set by the small departments and thereby not merely seek room but put into practice a concept that would be unique in our country. We in this country are strong in departments that are also clearly defined in theory and in the university structures, but this is not the case in the peripheral areas. The Anglo-Saxons are somewhat ahead of us here. A few weeks ago, at the end of October 1983, we as scientists had the unique opportunity to present these and other concerns in the provincial diet. We are extremely thankful for the fact that now the politicians as well are taking up the errors of past university legislation. Their support for this new gene center seems to us to be an impressive indication of how seriously these concerns are now taken.

Different Reactions to the Challenges

The following utterance is from Winston Churchill: "The empires of the future are the empires of the mind." Today this is the vision not only for science and politics but also for industry and the entire society. Industry has reacted to the challenge of gene technology in decidedly different ways. In the United States and also in England, scientists have founded many new firms that certainly will not all survive but that were truly indicative for the development of this area of work. In our country, this was extraordinarily difficult for various reasons ranging from a falsely and only roughly understood regulation of secondary work to the lack of risk capital. Instead, however, the classical chemical industry, especially Hoechst AG--which, of course, also had a product to lose, namely insulin--has taken up the subject in an unconventional way. It and Wacker-Chemie AG are now generously supporting this center. Thus the course has also been set for promotion by the federal minister for research and technology. We are extremely thankful for this. Allow me to quote from the conditions for authorization:

"The firm Hoechst AG, the consortium for electrochemical industries and other industry partners, as the case may be, have the opportunity to send employees to the involved institutes for training and advanced training. In this connection, the following attendant conditions are valid for the subprojects promoted by the Federal Ministry for Research and Technology:

--Industry employees can also work within the scope of the subprojects being promoted by the Federal Ministry for Research and Technology. The gene center must ensure that collaboration is also possible for additional working groups from outside;

--free flow of information and transfer of know-how between the participants;

--no exclusive rights;

--opportunites for other industry partners to join.

Mere observance of the Laws No Longer Enough

We for our part will certainly do everything we can to put these words into practice and thus also to contribute to technological development in this country.

From the beginning, the discussion of gene technology has also been linked with the problem of biological safety. Much has been said about this aspect in past years and especially in recent times. In this connection, allow me to begin with an old quotation:

Much is monstrous and nothing
more monstrous than man.
For he sails away over the gray sea
into the stormy south
pushing forward under
onrushing waves all around.
The earth as well,
the most divine of things,
that never fades away
and never tires, he exhausts
and burrows into it, pressing the plowshare
year for year with
horses and mules.

And further:

So beyond all hopes endowed with
cleverness
and ingenuity, going sometimes
bad and sometimes good.
He honors the laws of the land and of the
gods.
Sworn right--his city stands high.
No city has he
who boldly does what is shameful.

In view of the new dimensions and the new magnitudes of technical developments, this prize song of antiquity can probably no longer be applied without restriction to human technology. The mere observance of the laws alone is now no longer enough. For there is no doubt that we may, to be sure, continue to discover everything but perhaps should not always do everything possible with these discoveries. To go along with Hans Jonas, perhaps we should even progress from moderation in the use of power, which was always advisable, to moderation in the acquisition of power. Nevertheless, in no way is this to be

understood as a policy of renunciation but as a differentiation--not to forgo all courses of action but only certain particular courses and not to go beyond proper limits. What limits am I talking about? For us scientists it is manipulation of human reproductive cells and experiments in the cloning of human beings. Gene technology is already able to identify genetic defects in human embryos and/or in adults. And there should probably be no objection to correcting these defects through manipulation of somatic points, as long as the defects have a simple cause. Unacceptable, however, would be attempts to divide a human embryo--let us say at the 16-cell stage--into 16 separate cells and then to raise these as 16 cloned individuals. It would perhaps be even more reprehensible to manipulate these 16 separate cells in advance, as is now possible in animal breeding--in mice, for example. In this connection, it should be noted that one could go a step further in this business--to the cloning of adult humans. In contrast to an embryo, one can, of course, identify in every person certain attributes for which a person might have an interest in seeing himself represented several times. In this connection, it must be said that such experiments are not even successful with relatively low organisms such as frogs, not to mention with mammals such as mice, for example. This may have to do with the fact that the somatic cells of adult organisms are no longer completely potent and irreversible chromosome changes have taken place in such cells so that these cells are no longer able to go through every development state of the growing organism.

Limits of Manipulations

They would need to do this if an intact whole organism is to develop from a single such cell--a skin cell, let us say. At this time, it is not possible to indicate whether there may be a fundamental limit at this point in biology, a boundary that we can never go beyond. And even if the expectations that we have had in gene technology in the last 15 years were always fulfilled, if not exceeded, we have not made substantial progress in this aspect of cloning entire organisms.

In summary, it is important to say that there are not only enormous quantitative but also qualitative differences between the transfer of individual genes and manipulations on a complete set of genes as they are represented in a cell. It is similar to the difference in the locomotion of a person who cannot rise into the air under his own power but with the appropriate means has entered into a new, in this case largely pleasing, dimension of worldwide air traffic.

Enlightment Is Needed

These problems cannot be made very clear to the public, for the public has no good conception of the complexity of genes and especially of their dynamics. Astronomers make use of light years to explain the endless distances of the universe, and the finance ministers should perhaps speak of light marks when debts exceed a billion marks. Molecular biologists have heretofore not really stood in the limelight so as to give thought to these matters. But they should do so now, for a new wave of discussion is sweeping over our country, a discussion that is ignoring this fundamental difference between the transfer of individual or a few genes and the manipulation of what is a "black box" for us

too, namely the genetic system of man. It will require the common efforts of all those involved, scientists and politicians, to see that our country is not cut off from this area of work and these techniques and to secure for it its place in the "empire of the future as the empire of the mind."

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CSO: 3698/165

GERMAN GENETIC RESEARCH INTO PLANT DISEASE

Frankfurt CHEMISCHE INDUSTRIE in German Nov 84 p 708

[Text] Viruses are more and more often determined to be the pathogenic agents of plant diseases. Improved diagnostic procedures now make it possible to identify these microorganisms, declared Dr Hans Ludwig Paul, director of the Federal Biological Institute in Brunswick, at a plant protection conference in Giessen. To combat the pathological agents, more resistant plants need to be cultivated with the help of botanical methods.

Meanwhile, research in Giessen has proved that plant viruses are now found in rivers as well. Presumably they get into the waters directly from the diseased plants or through the soil. It was further stressed that viruses, without causing visible damage, could lead to a reduced harvest for fruit trees.

New methods of biological plant protection are now being tried to protect useful plants from viral attack. Prof Dr Fritz Schoenbeck (Hanover) pleaded for procedures that improve the resistance of plants without thereby changing their genetic constitution. In this "resistance induction," virus-repulsing fungi are cultivated in a nutrient solution. The resulting product is subsequently sprayed on the underside of the plant leaves. This method, which Schoenbeck compared with the vaccination of a person, apparently activates the defensive system of the plants.

The same purpose is served by the development of plants resistant to viruses. According to Prof Dr Gerhard Fischbeck (Munich), this will be more and more important in the future to repress disease-prone varieties. Meanwhile, with the help of gene technology, it has been possible to development resistant plants from isolated and resistant cells of potatoes and rape. With the multitude of viruses and plant varieties, to be sure, it is still a long way to the development of permanently resistant plants for efficient cultivation systems.

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CSO: 3698/165

AUSTRIAN DEVELOPMENTS IN BIOCHEMISTRY, BIOTECH

Vienna DIE PRESSE in German 21 Nov 84 Supplement p VI

[Article by Hans G. Oetzbrugger: "Biochemistry: Years of Austrian Experience in Biotechnology"]

[Text] Biochemistry, Austria's Largest Producer of Antibiotics

Since the discovery of the acid-stable Penicillin V by Kundl scientists, Biochemie GmbH has developed into Austria's largest producer of antibiotics, but it has also established an internationally recognized name. Having started with this Penicillin V, which for the first time can also be given orally because of its resistance to stomach acids, the firm now offers a range of antibiotics products covering practically all of modern chemotherapy.

The Economic Importance of the Firm

Almost 1,400 employees are working in the enterprise. In addition, approximately another 1,500 Austrian jobs are secured through advance performance arrangements and purchasing power effects. In the period between 1980 and 1983, sales almost doubled and have now reached a level of over 2 billion schillings. About 86 percent of these sales were achieved abroad against the stiffest international competition. The expansive nature of the firm is underscored by the fact that in recent years there has been almost 10 times as much investment for expansion as for replacement or rationalization.

Biochemie as a Biotechnology Firm

The special strength and experience of Biochemie is in the area of the fermentative production of antibiotic substances. In fermentation, the raw materials are produced through microorganisms, which during their growth--technically stimulated through the optimization of environmental conditions--simultaneously produce these raw materials as well. For some time now, the research and development department of Biochemie has concentrated its activities on the stock improvement and fermentation of such microorganisms as well as on the processing and chemical refinement of substances produced by them. Whereas heretofore there has been an attempt to achieve greater yields in the "trial and error" method through mutation, hybridization, subsequent selection and recombination of the stock material, now the spectular progress in molecular

genetics is opening up possibilities to construct improvements, as it were, through cloning. In the case of Biochemie, this scientific progress fell on fertile soil. With the recent completion of two genetic laboratories, it will also participate in basic research in this new and very promising technology.

Only in this way was it possible to produce biotechnologically the antiviral Alpha-Interferon and the immune-modulating Interleukin-2--at the forefront worldwide--on an industrial scale here in Austria. With its production and research activity, Biochemie is thus deeply rooted in a technology from which specialists hope to see the beginning of a new industrial revolution and whose potential for industrial application still cannot be fully assessed.

With Cyclosporin A in a New Era of Transplant Surgery

Biochemie has been affiliated with the Sandoz concern wince 1964. This is important for the firm for two reasons. On the one hand, the moving of the entire fermentative substance production from Basel to Kundl provided for capacity utilization and continual growth in fermentation capacities. On the other hand, it was possible to concentrate a large part of the research and development forces on Biochemie's strengths in improving stock and in fermentation. Thus among other things, the first stages of the immune suppressant Cyclosporin A are fermented here in Kundl. This substance has the property, working through the human immune system, of specifically suppressing rejection reactions against foreign tissue. In normal cases, to be sure, this specificity of the immune system's way of reacting helps to preserve life, but it can be deadly in connection with organ transplants. In the unanimous opinion of leading pharmacologists, the immune suppressant Cyclosporin A has brought a true therapeutical breakthrough and has increased the probability of success for kidney transplants to 90 percent, for example. The spectacular successes of the recent heart transplants in Austria would also hardly have been possible without this drug.

The Prospects for the Future

To be able to hold its own in the "sunrise technology" of industrial microbiology in the future as well, Biochemie devotes almost 10 percent of its turnover for research and development purposes and employs about 200 people in this area. The contemporary focal points in research in genetic engineering and enzyme technology are thereby taking a continually growing share for themselves, whereby the firm has begun to push forward into the area of high-quality fermentatively produced industrial products and is making a greater effort to expand and round out its field of activity outside of pharmaceuticals.

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CSO: 3698/165

JPRS-WST-85-004
30 JANUARY 1985

FRANCE'S FAIBIS CALLS FOR FURTHER INITIATIVES

Paris AFP SCIENCES in French 11 Oct 84 p 70

[Article: "French Biotech Initiatives Inadequate"]

[Text] Paris--At a press conference presenting the results of his work October 11 in Paris, Mr Laurent Faibis, author of the study "Biotechnologies and Biotech Industries in France", described French industrial efforts and initiatives in biotechnology as inadequate. His judgment is discouraging. According to Mr Faibis, France is falling behind in biotechnical industries, which threatens in the long run to shrink the share of the world market (about 10 percent) held by French pharmaceutical, agro-food and high-tech chemical groups. The figures tell the story: according to experts, Nemours Dupont, the world's top chemical company, channels 120 millions dollars a year into biotechnological research, while the largest companies in France spend in the neighborhood of 15 million dollars a year.

But the danger is also that the large international high-tech chemical companies, for example, intend to exploit their competence in biotechnologies to penetrate other markets, such as the pharmaceutical. Mr Faibis stressed that the days of compartmentalization are over: competitors for a single market will come from very diverse backgrounds. A recent example is a Japanese alcohol manufacturer who has begun producing interferon using genetic techniques.

French industry's mistake may be one of "blind imitation", the author noted, of attempting to catch up with firms which have an established technological lead and powerful resources. According to him, the Japanese have adopted a different strategy: immediately foreseeing which technologies will be utilized in the future, they focus their efforts on preparing the next technological generation.

As a final point, he noted that in the United States "venture capital", that is, investment in high technology for profit, is easily managed, despite a failure rate of nearly 85 percent. "When Euorpean bankers are ready to accept similar risks on high-tech investments, things will be easier," he remarked, noting that French industrialists establish dompanies in the United States in order to innovate in high-tech sectors.

Mr Faibis' study was commissioned by "BIOFUTUR", a monthly magazine devoted to biotechnology in industry created with the support of Jean-Pierre Chevenement when he was minister of research and industry. The document is a survey of the development of biotechnologies in companies.

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CSO: 3698/159

JPRS-WST-85-004
30 JANUARY 1985

ELF-SANOFI EMERGING FRENCH LEADER IN BIOTECH

Paris LE FIGARO in French 16 Nov 84 Special Economic Section p I

[Text] With the consolidation of all its biochemistry-related activities, the Elf-Aquitaine group is preparing to create the first French biotechnology base, with sales, including the medicines division, of 4.45 billion francs.

Things are finally moving in the biotech industry. At a standstill for over 2 years despite the proliferation of speeches on the merits of high technology, yesterday the Elf-Aquitaine group announced it was going to create a single unit consolidating all of its biochemistry-related activities, currently dispersed among several different companies.

The new unit, under the direction of the pharmaceutical subsidiary of the group, Sanofi, will become the largest French biotechnology base: sales of all products derived from biochemical techniques, including medicines, will total 4.45 billion francs.

And this is only the beginning. In announcing the change, Michel Pecqueur, Elf's president, made it very clear that "this reorganization is being implemented with an eye toward development," adding shortly afterwards that he intended to allocate "several hundred million francs a year" to investments--including acquisition.

Thus, in addition to its pharmaceutical activities (6 billion francs in sales) and perfumes and cosmetics (around 3.5 billion), Sanofi will become an agro-biotechnological holding company, in conjunction with its parent company Elf, which will retain a minority interest.

This new firm, as yet unnamed, will head up production presently handled by four separate companies, whose sales alone are worth 3.3 billion francs. They will be reorganized into 3 sectors:

1. Food additives and flavorings. Sanofi and the American company Daryland Food, with its acquisition of shares in Entremont, have already established a strong foothold in this area. In addition, this group will incorporate the food additive line of CECA, the third largest producer of algae-derived products in the world (around 300 million in sales).

2. Rousselot's proteins, fats and gelatins (2 billion francs in sales, excluding chemistry). Rousselot is the world's largest manufacturer of gelatin. Production of human and animal food products, which Sanofi believes will be a strong growth area, will be based in this group.

3. Agriculture-related activities: animal health and feed, seed production (Elf Bio-Industrie-Rustica). Manufacture of meat flours, phosphates and mineral salts for livestock, which are currently being produced by Rousselot, will be handed by this group.

300 Researchers

Finally, Sanofi's biotech industries and those of the entire group will have access to important potential biotechnological research resources, of which the Labege laboratories near Toulouse, scheduled to open in a few weeks, will be the principle center. There will be a total of 300 researchers and a budget of around 400 million francs.

It is obvious that the Rousselot company is central to the reorganization plan. Elf owns 67 percent of the stock of this subsidiary.

About 30 percent of the capital, however, is in public hands. Consequently, Sanofi has launched a "merger-incorporation" drive, based on the exchange of 2 Sanofi shares for one Rousselot share (see Stock Exchange page).

In the long run, Mr Pecqueur indicated, Rousselot's purely chemical activities will be separated and transferred to Atochem. The presidency of Sanofi and its subsidiary Agro-Bio-technologie will remain in the hands of the man Michel Pecqueur referred to, in a not inappropriate lapse, as "Mr Sanofi": Rene Sautier.

It was 2 years ago that Jean-Pierre Chevenement, at that time minister of industry, devoted one of his "mobilization programs" to biotechnologies and only recently that an independent expert report insisted that efforts in this area "are still inadequate to guarantee our country a first-class standing". It was high time that France realign and organize its forces.

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CSO: 3698/159

JPRS-WST-85-004
30 JANUARY 1985

FRENCH PROPOSE NEW FINANCIAL YARDSTICK FOR INDUSTRY

Paris BIOFUTUR in French Nov 84 pp 65-67

[Article and commentary by Ghislain Garczynski, CCF financial analyst: "New CCF/Biofutur Index." Statistical assistance provided by the CCF [French Commercial Credit Bank] Economic and Financial Study Office, data processing group, Marc Chedebois, director.]

[Text] The biotechnology market has greatly changed during the last 2 years.

In order to follow the stock exchange behavior of such a diverse sector, ranging from highly specialized companies--most of which have only existed for a few years--to large, established groups in the pharmaceutical, chemical and agro-food industries, a statistical index capable of accurately reflecting the structure and evolution of this sector is needed. In an attempt to improve exchange information in this sector, BIOFUTUR is proposing a new index.

To gauge this evolution, the sample of values included in the index was revised, but their number (20) and equal distribution between specialized American companies and diversified groups "with an interest in biotechnology growth" were left unchanged.

In the first group, Applied Biosystems, Biogen and Damon Biotech replaced Collaborative Research, Flow General and Monoclonal Antibodies.

In the second group, the introduction of two French companies heavily involved in biotechnology (the Merieux Institute and Orsan) as well as the Dutch firm Gist Brocades (second largest world producer of enzymes after Novo) and two also very significant Japanese groups (Ajinomoto and Meiji Seika) seemed justified. On the other hand, Amersham, Bio-Isolates, Glaxo, Sankyo and Takeda were dropped from the index.

Among the large American pharmaceutical groups showing increasing interest in biotechnology, Schering Plough, which probably has the most significant strategy in this regard, has been added.

To get a better handle on this sector's exchange evolution, the "exchange capitalization"[1] of each value should be taken into account, which amounts to assigning it an index weighting [in boldface] exactly proportional to its economic importance. This avoids an artificial overemphasis on fluctuations (up or down), particularly those caused by small specialized companies which often fluctuate wildly.

Moreover, to ensure that this method does not give disproportionate weight to large industrial firms with interests in biotech growth compared to the specialized companies group, whose exchange capitalizations are generally much lower, it was decided to calculate two sub-indexes, that is, an index for each group, and to calculate the overall index by figuring the simple mathematical average of the two components.

Finally, the baseline for the next index was set at December 31, 1982 instead of December 31, 1981, as previously.

Exchange Commentary

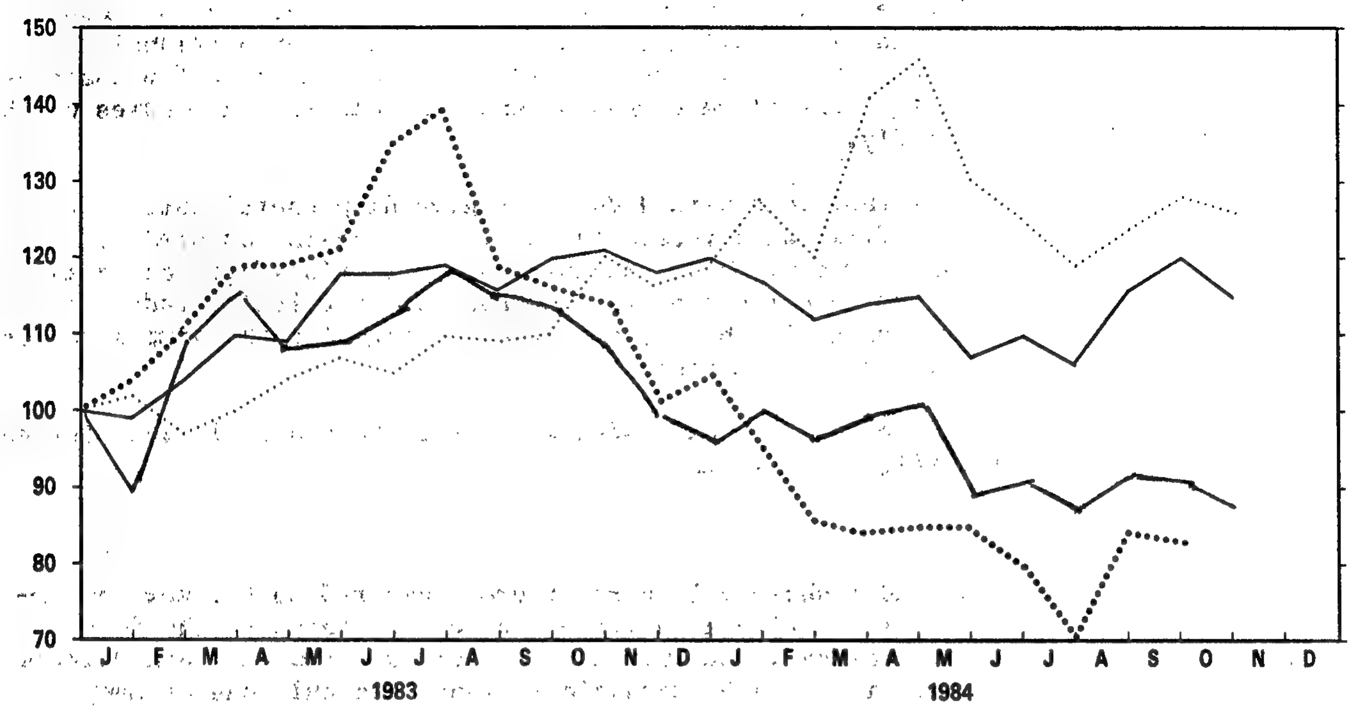
The CCF-BIOFUTUR index shows a 12 percent drop compared to the new end-of-1982 baseline, itself a record high (up 30 percent compared to the former, December 31, 1981 baseline). During the same period, Hambrecht and Quist's technological index, in which biotechnology figures as only one of many components, was more volatile still, showing a drop of nearly 20 percent.

Market caution towards American biotech companies, apparent since July, 1982, is clearly shown by the drop in this sector's index (down 25 percent compared to the end of 1982), while the diversified group index is practically at the same level as the baseline.

Caution is still advisable, therefore, when considering biotechnology stock. Although earlier excesses now seem to have been largely corrected for, the market is probably reluctant to move ahead again until companies' prospects become more clear. A number of experts believe (cf a recent FINANCIAL TIMES report) that the focus in biotechnology is shifting from "venture capital" type companies to well established groups, particularly in pharmacy and health. As an example of this development, in 1984 these groups will spend three times as much money on biotechnology research and development as the new American "biotech" companies (1,500 million U.S. dollars versus 500 million U.S. dollars).

[Graph on following page]

1. Exchange capitalization is simply the product of the number of shares comprising the company's capital and the share's exchange price, the latter adjusted for possible capital increases.



Companies	12/31/82	10/11/84
———— Dow Jones (USA)	1,031.36	1,183.08
. . . . . D.J. 225 (Japan $)	34.05	43.03
o o o o o H.Q. Techno (USA)	655	
———— CCF/Biofutur (in $)	100	88

Becton Dickinson & Co (Paramus, NJ, USA) plans to acquire 20 percent of the shares of Applied Biosystems Inc. (Foster City, CA, USA). Ten percent of the shares will be purchased at 26 dollars per share (for a total of 17 million dollars). Becton Dickinson has also secured the right to acquire an additional 625,000 shares (10 percent) a year from now, at 30 dollars per share. The two firms plan to develop jointly products for diagnostic use which will be distributed by Becton Dickinson. Each firm will retain the rights to technologies developed outside the sphere of the agreement signed.

Biotechnica International (Cambridge, MA, USA) has registered a patent for a process regulating gene expression in cells altered by genetic engineering. The method would make it possible to control the effectiveness of "promote" sequences without interfering with cell growth. (Source: EUROPEAN CHEMICAL NEWS, Sep 10, 1984)

Calgene Inc (Davis, CA, USA) anounced at the beginning of September, 1984 that is had signed an agreement with Campbell Soup Company to develop new varieties of tomatoes. The goal is to achieve a tomato with 50 percent more pulp than normal tomatoes. Eighty-five percent of the tomatoes used in the U.S. food industry are grown in California. (Source: CALGENE COMMUNIQUE)

Cetus Corp (Emeryville, CA, USA) decided the terms of a final agreement the end of August, 1984 on the creation of an agricultural "joint venture." Grace's Agricultural Chemical Group (Memphis, TN, USA), a W.R. Grace subsidiary, holds a 51-percent interest in the new firm, Agracetus, and Cetus Madison Crop. (Middleton, WI, USA), a Cetus Crop. subsidiary, holds a 49-percent interest. Agracetus will focus its research and development efforts on crop improvements and processing and on animal health products. Agracetus will be located in Middleton. Moreover, Cetus, which has just published its annual report, hopes to begin clinical testing of an immunotoxin for lung cancer within the next 6 months. This product may be on the market by 1989.

Along the same lines, Cetus is also studying the potential use of immunotoxins in bone marrow transplants. Donor marrow contains T lymphocytes which, when transplanted to the patient, attack its own cells as if they were foreign bodies. The immunotoxins may make it possible to eliminate the T lymphocytes ex vivo, before grafting, and thus prevent graft rejections. (Sources: Cetus 1984 Annual Report; Cetus communique; SCRIP, Aug 8, 1984)

Eisai Co and Toshiba Medical are collaborating in the marketing of reagents and immunoenzymatic test materials. Eisai will oversee the manufacturing and Toshiba will handle sales. (Source: JAPAN CHEMICAL WEEK, July 19, 1984)

Eastman Kodak has invested 8.4 million dollars in ICN and its subsidiary Viratek. This shareholding acquisition is related to a pharmaceutical biotech research agreement. (Source: SCRIP, July 11, 1983)

Genentech has announced that it has cloned the gene which codes for human TNF (Tumor Necrosis Factor), a potential anticancer agent. Moreover, Cutter Biological, a subsidiary of Miles Laboratories, Inc, and Genentech signed an accord the beginning of September which granted Cutter worldwide manufacturing and marketing rights for Factor VIII, extracted through a genetic engineering technique developed by Genentech. After Cutter has marketed the product for the first 2 years, Genentech will be able to market it in the United States and Canada. (Sources: McGraw Hill's BIOTECHNOLOGY NEWSWATCH, September 17, 1984; Genentech communique)

Le Gerdat and Rhone-Poulenc Agrochimie: scientific cooperation accord to be signed.

A general scientific cooperation agreement in the field of tropical plant health protection should be signed in the near future by GERDAT (Study and Research Group for the Development of Tropical Agronomy) and Rhone Poulenc Agrochimie.

It will consist of a permanent exchange of information on plant health problems and on the research programs of the two partners.

It also includes a training component for Rhone-Poulenc teams required to work overseas. Also covered in this accord: the two partners will examine

the possibility of joint research programs whose funding, duration and location will be studied separately in each individual case and which will be subject to the cooperation agreements regulating GERDAT's activities in more than 50 overseas countries. (Source: GERDAT communiqué)

Green Cross Corp is focusing part of its research and development activities on the development of liposome preparations containing therapeutic substances. The company applied for authorization to produce "Lipo-steroids" (dexamethasone palmitate encapsulated in lipoid particles for use in the treatment of rheumatoid arthritis) last May. These products may be put on the market by 1985. (Sources: JAPAN CHEMICAL WEEK, September 6, 1984; SCRIP, August 15, 1984)

Hazleton Biotechnologies Corp (Vienna, VA, USA) a Hazleton, Corp Subsidiary and Cellular Products Inc (Buffalo, NY, USA) will team up on a research project involving the production of monoclonal antibodies for diagnostic tests. Cellular Products will furnish highly purified antigens taken from blood products. The first monoclonal antibodies to be developed will be those which specifically recognize PDGF (Platelet Derived Growth Factor) and human gamma interferon. (Source: Cellular Products Inc communique)

Hybridoma Sciences (Atlanta, Georgia) is acquiring ICL Scientific's (Fountain Valley, CA) diagnostic market. (Source: BTN, September 1, 1984)

ICI and Cardo have shelved a possible cooperative project in the area of biotechnological applications in agriculture. (Source: CHIMIE ACTUALITE, September 17, 1984)

Infergene Corp (Bencia, CA, USA) founded a year ago, is slated to begin industrial scale development of genetically engineered enzyme extraction processes for the food industry at the beginning of 1985. One of the firm's managers, James B. Glavin, is also president of Genetic Systems (Seattle, WA, USA) (Source: GTN, Sep 1984)

Interferon Sciences (New Brunswick, NJ, USA) and Fudan University (Shanghai, China) have signed a cooperation agreement for the development of cloning systems for rice and other grains. (Source: GTN, Sep, 1984)

Specialized Biotech Companies (Research, Products, Equipment)

(In U.S. $)	Monthly price 10/11/84	Last No price 9/14/84	% of Change	Opening Price	Price Range (12 mo)	Exchange Capitalization (millions)
Advanced Genetic Sciences	4	4.125	-3.0	15	15-3	43
Amgen	4.5	5	-10.0	18	18-5	51.4
Applied Biosyst*	25.5	27.25	-6.4	17	27-17	106.6
Biogen*	7.25	9	19.4	23	16-8	134.3

[Table continued]

(In U.S. $)	Monthly price 10/11/84	Last No price 9/14/84	% of Change	Opening price	Price Range (12 mo)	Exchange Capitalization (millions)
Biot Research Labs	9	9.25	-2.7	10	20-6	43.4
Bio Response	6.5	7.875	-17.5	12.5	16-7	52.6
Cetus*	9.875	10.5	-6.0	23	16-10	218.8
Centocor*	9.5	11.25	-15.6	14	17-9	61.3
Chiron	5.25	5.5	-4.5	11	13-5	52.5
Collab. Research	4.875	5.75	+15.2	11	15-6	48.4
CooperBiomedical	3.75	5.5	-31.8	10	11-5	58.9
Damon Biotech*	6	6.625	-9.4	17	11-6	115.3
Enzo Biochem	17.5	15	+16.7	1	28-12	152.7
Flow General	4.625	5.75	-19.6	-	14-4	40.8
Benentech*	29.75	34.75	-14.4	23	45-26	377.1
Genetic Engineer	3.5	1.75	+100	5	10-1.5	7.5
Genetic Labs	4.75	4.625	+2.7	2	6-4	29.7
Genetic Systems*	6.75	7.5	10.0	2	12-6	133.4
Genex*	10.125	10.625	-4.7	9.5	19-8	129
Hybritech*	14.25	13.5	+5.6	11	21-11	142.7
Immunex	5	5.25	-4.8	11	14-5	27.3
Immuno-Nuclear	3	3.25	-7.7	17.5	10-3	6.5
Integrated Gent	4	3.625	+10.3	13	13-3	31.6
Interferon Sciences	3.75	4.25	-11.8	6.3	6-3	9.7
Interpharm Labs	3.75	3.75	-	6.3	7-3	19.4
Molecular Genet	7.5	9.25	-18.9	9	18-8	46.2
Monoclonal Antib	10.5	10	+5.0	10	23-10	20
Millipore*	32.375	31.625	+2.4	-	34-36	443.3
Ribi Immunochem	9.25	8.5	+8.8	2	16-6	23.5

CCF/Biofutur Specialized Companies Index: 75/48

Greatest declines in specialized companies index since 9/14/84:

Cooper Biomedical	31.8%
Flow General	19.6%
Biogen	19.4%

Greatest increases in specialized companies index since 9/14/84:

Genetic Engineering	100.0%
Enzo Biochem	16.7%
Integrated Genetics	10.3%

*Company included in the CCF/Biofutur index.

Sample of Industrial Companies With an Interest in Biotech Growth

France (FF)	1,365	1,340	+ 6.3	1,380-720
Merieux Institute*	1,365	1,340	+ 6.3	1,380-720
Roussel Uclaf	1,710	1,490	+18.6	1,496-700
Sanofi	545	537	+15.5	582-449
Orsan*	564	531	+ 4.1	628-491
Great Britain (Lb)				
Beecham	3.66	3.56	+ 2.8	20-3
Glaxo	9.70	9.65	+ 2.1	10-6
Sweden ($)				
Pharmacia*	23.75	18.875	+25.8	31-14
Denmark ($)				
Novo	34.125	36.365	- 6.2	74-36
The Netherlands (Fl.)				
Gist-Brocades*	168.5	169.5	- 0.6	171-129
Japan (Yen)				
Ajinomoto*	1,110	1,190	+ 2.6	1,210-810
Asahi Chemical	560	551	+ 1.6	882-350
Fujisawa	1,060	1,050	+ 0.9	1,130-715
Green Cross*	1,680	1,620	+ 3.7	1,900-1,460
Kyowa Hakko*	880	850	+ 3.5	925-775
Meiji Seika*	490	521	- 6.0	535-490
Sankyo	915	828	+10.5	845-660
Shionogi	691	670	+ 3.1	815-590
Takeda	832	760	+ 9.5	802-651
United States ($)				
Abbott	38.5	46.625	-17.4	53-38
Collagen	9	8.5	+ 5.9	25-8
Eli Lilly	57.375	56.875	+ 0.9	68-53
Merck	81.375	85.75	- 5.1	105-78
New Brunswick Scient	7.75	8.75	-11.4	20-7
Pfizer	34.125	37.125	- 8.1	25-29
Schering Plough*	34.25	36.75	- 6.8	44-33
Searle	60.5	50	+21.0	55-37
Smithkline Beckm	54.25	56.75	- 4.4	70-50
Syntex	47.75	47.5	+ 0.5	61-38
Upjohn	53.875	54.25	- 0.7	71-45

CCF/Biofutur index of companies with an interest in biotech growth: 100.44

*Company included in the CCF/Biofutur index.

Sample of French Companies with Biotech Strategies

	Monthly Price	Last Month's Price
Air Liquide	559	550
PSN	2,580	2,600
Clause	590	520
Degremont	130	126.6
Elf-Aquitaine	254.50	231.8
From Bel	1,035	843
Moet-Hennessy	1,843	1,745
Pernod-Ricard	750	803
Robertet	508	487
Rousselot	910	915
Speichim	119.6	101.5

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RESEARCHERS, PROJECTS AT FRENCH INTELLIGENT MACHINE CENTER

Paris MINIS ET MICROS in French 24 Sep 84 pp 39-40

[Article by Xavier Dalloz: "The Activities of the Intelligent-Machine Research Institute"]

[Excerpts] A few months ago (December 1983), the Grenoble National Polytechnic Institute (INPG) created the Intelligent-Machine Research Institute (IMI) whose projects are quite ambitious, as can be seen from the following article which gives a summary of IMI activities.

At the INPG, 650 people are engaged in research in 22 laboratories, 19 of which are associated to the CNRS [National Center for Scientific Research]. Their research is done in close relation with the industrial world. During the 1980-1983 period, 49 patent applications were filed; 32 research grants were financed by manufacturers in 1983, and industrial contracts amouting to FF 12 million were signed that same year.

Most of the firms located in the Scientific and Technical Innovation and Development Park (ZIRST) of Grenoble were created by former students of the INPG.

The INPG wishes to keep giving preference to its contracts with the industrial sector and, to that end, it just launched a broad program of data-processing research, in order to introduce the concepts of artificial intelligence into several projects on which all of its teams are going to work. This major effort will help increase the interest shown by the data-processing industry for the results obtained by INPG researchers.

Artificial intelligence will certainly initiate a technological revolution more important and more profound than the present data-processing revolution. The INPG is already stating that this will offer many opportunities to the French industry.

To launch a research program like the IMI program, it must be possible to regroup data-processing, robot and electronics experts at one location, and to be supported by basic research so as to master the complexity of the systems

considered. It also requires an environment in which experimental development is possible, in microelectronics as well as in robotics and data processing.

All these prerequisites are met at the INPG. The research teams cover the range of required competence and are complemented by a smooth-running experimental support. And all these research units will be regrouped at one location before the end of 1985. Over half of the personnel will already be on site before the end of 1984.

There are five laboratories or research teams: the LIFIA (Basic Data-Processing and Artificial Intelligence Laboratory), the research team on computer architecture and VLSI design, the LCP (Voice Communication Laboratory), the LITRF (Image-Processing and Shape-Recognition Laboratory), and the Robotics Center.

In the next section, we are giving the breakdown of the personnel and activities of the various laboratories and research teams.

In the IMI, these five INPG teams pool their resources to work on two types of projects:

1. Projects contributing new functions or organs to the "intelligent machine";

2. Projects using the results of research on artificial intelligence to develop other projects at the IMI.

The LIFIA and the LITRF are already cooperating on several projects involving vision systems, as well as with the VLSI computer-aided design team for the development of systolic architectures* made of silicon, on the one hand and, on the other hand, for the development of formal-computing circuits.

In the future, other projects will be developed, in particular to design a circuit for unification and another one for parallel (neuronic) processing. As far as artificial-intelligence applications are concerned, we should also mention the projects involving the implementation of expert systems, on the one hand to design components and, on the other hand, for voice recognition.

Research Teams: Breakdown and Activities

LIFIA (a total of 42 researchers):

- Basic data-processing (19 people): generic and application programming; parallelism and communicating processes; specifications and real time; program synthesis and automatic demonstration; formal computing.

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* A systolic architecture is a parallel architecture that regularly transmits data in the form of packets (just as the heart sends blood into the arteries with each heartbeat). This type of architecture is designed to improve the resolution of Fourier transforms and is well suited for systems related to signal processing.

- Artificial intelligence and robotics (18 people): reasoning modeling, instruction; expert systems; visual perception; robot programming.

- Musical and Graphic data processing (5 people): language and systems for instrument definition and sound synthesis; gestural transducers and image synthesis for instrument playing.

VLSI (44 researchers):

- Silicon compiler for complex digital circuits defined according to their behavior (18 people): automatic design of control and operating parts; design of microprocessor-control parts; optimization and design of large programmable logic arrays.

- Tools for the realization and development of complex circuits (8 people): graphic interactive tool to draw VLSI masks; circuit development using a scanning electronic microscope.

- Functionally distributed systems (5 people): Prolog database machine; distribution of a system on specialized processes.

- Operational safety (13 people): on-line and off-line testing of microprocessors, functional and analytical RAM testing; operational safety in distributed systems; self-testing circuits, special integrated circuits, failure simulation.

LCP (33 researchers):

- Voice production, analysis, synthesis (9 people): simulation of the vocal conduit; analysis and synthesis of French sounds; spoken outputs; synthesis through analogy with the vocal conduit, formative synthesis.

- Speech perception (8 people): modeling of the peripheral auditive system; perception testing.

- Encoding-decoding, speech recognition (6 people): pre-processing, comparison procedures; syntax use; dialog, instruction; data compression.

- Phonetics (10 people): study of traits and clues; intonation, analysis-synthesis, individual characteristics; written code, spelling-phonetic transcription.

LITRF (18 researchers):

- High-speed-processor algorithms and technology (9 people): image processing, texture analysis and RVB [expansion unknown] analysis; processors for vision.

- Optical reading and shape recognition (4 people).

- Neuronics (5 people): simulation of neurone networks; parallel processing for shape recognition.

Robotics Center (now being created); projected research fields:

- Robot programming-control: flexible-manipulator control; sight-control association; robot programming.

- Visual perception: high-speed specialized processes; image-interpretation software; vision-system programming.

- Expertise in the sense of touch: sensor technology; processing software.

- Reasoning modeling: assembly-sequence design; automatic synthesis of assembly programs; automatic diagnostic; robot-operator decision-sharing.

- Geometric modeling: processing alrorithms; representation of objects and scenes.

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FRENCH FIRM DEVELOPS 2D, 3D COMPUTER VISION SYSTEM

Paris MINIS ET MICROS in French 24 Sep 84 pp 41-43

[Article by Rosalie Hurtado: "A Visit to the ITMI Company: From Real-Time Vision to Industrial Robots"]

[Excerpts] Few French firms are created around subsectors as highly specialized as artificial intelligence or computer vision. ITMI [Intelligent-Machine Industry and Technology] confronted this challenge, which it intends to win through technology transfers. It became a partner of Hewlett-Packard for robotics, for a control cabinet. But ITMI has other strings to its bow.

Of the four people who initiated the creation of ITMI in August 1980, two came from the LIFIA (the Basic Data-Processing and Artificial-Intelligence Laboratory of the National Polytechnic Institute of Grenoble [INPG]) and two from SCEMI [expansion unknown] (a robot manufacturer of Bourgoin-Jallieu). A contract covers the collaboration of the INPG and ITMI, and the latter pays back to the Institute a percentage of its sales resulting from technology transfers.

This relation of the INPG with the industry has generated several products, in particular in the field of robotics.

Real-Time Computer Vision

The computer-vision prototype developed by the ENSERG (National Advanced School for Electronics and Radioelectronics) was adapted for the industry by ITMI. The object of the system, which is called "Real-Time Gradient" or GTR, is to extract the contours of an object in real time (Figure 1). It digitizes the image into 64 levels of grey and uses an operator to analyze image contrast. The response time is extremely short, as digital processing is carried out simultaneously with image scanning. Cable technology alone, without any microprocessor, could make such high-speed execution possible. In addition to speed, a second advantage should be mentioned, the capacity to adapt to variable light conditions, and therefore to any type of industrial lighting.

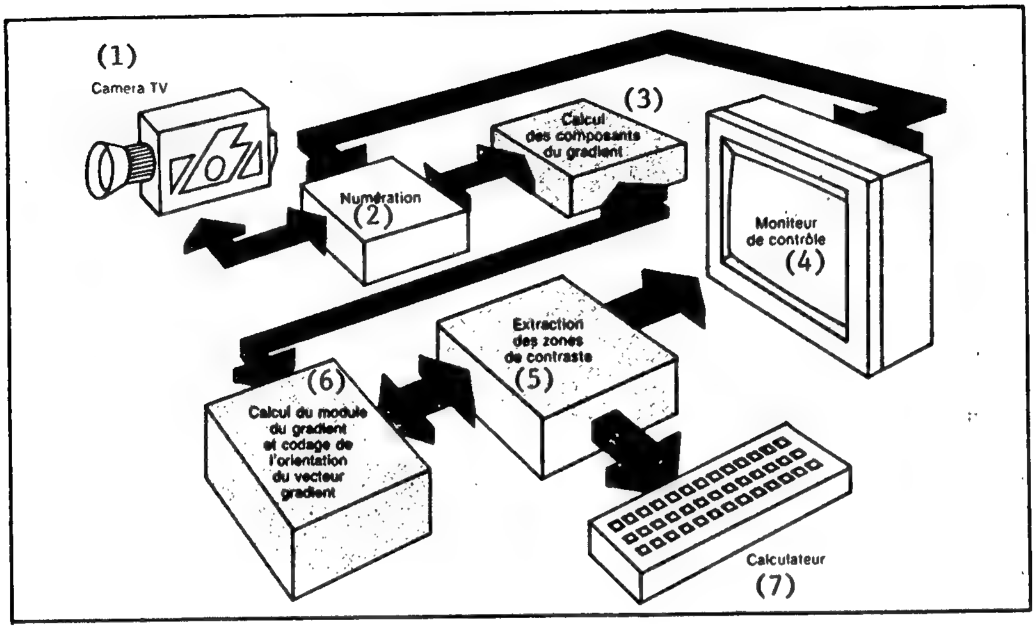

Figure 1. Architecture of the GTR System Designed by the ENSERG and Industrialized by ITMI

Key:

1. TV camera
2. Digitization
3. Computation of gradient components
4. Control monitor
5. Extraction of contrast areas
6. Computation of the gradient modulus and coding of the gradient vector
7. Computer

Other hardware systems currently researched, taking into account color and texture, should be completed early in 1985. For the time being, the GTR appears to be without equivalent on the market, even in the United States where the processor was exhibited twice (in Chicago and in Detroit). The role of the U.S. subsidiary, among other things, will be to gain access to the international market with the GTR.

Some 30 GTR have been sold for various applications: sorting bulk parts produced in a foundry; visual control of the quality of various materials such as leather, glass or wood. For wood, for instance, the system does not just reveal defects through an ordinary vision program; it uses an intelligent strategy to characterize the defects and decide whether or not they are acceptable, based on production requirements.

GTR works on Hewlett-Packard (HP 1000) and Digital Equipment computers. The system requires 16-bit computers (8086 and 68000 microprocessors) and costs FF 50,000; the camera, which is freely chosen by the user, costs between FF 6,000 and FF 30,000.

Two Software Packages Suitable for the GTR

Caiman and PVV are two software packages which use the GTR for a particular application.

Caiman (Conversational System for the Analysis of Digitized Images) is a series of modules that can be linked. It regroups a large number of image-analysis operators.

PVV (Vision Forecasting and Checking) uses an artificial-intelligence strategy to locate and recognize objects that can even be partially hidden. Its job is to detect global or local visual clues which characterize a part (center of gravity, circumference, height, radius of curvature, straight-line sections, angles, etc.). When it feels it has enough clues to recognize the part, it stops. Otherwise, it backtracks along a tree structure until it finds the solution. This sorting system is used mainly to control parts.

Laser GTR For the Third Dimension

The idea is to increase the visual-perception capacity of a robot and enable it to acquire data concerning the relief of a scene or object. To achieve this, a helium-neon laser equipped with a cylindrical lens producing a light plane is added to the GTR system.

The laser projects a light line on the object of the scene to be analyzed, and that line is perceived by a camera provided with an optical band-pass filter focussed on the laser wavelength. The position of the line in the image is used to compute the third dimension.

V3D is complemented by a software package that can achieve the following functions: filtering the light line defined by the vector; cutting the line into a sequence of straight-line sections; automatic sensor calibration

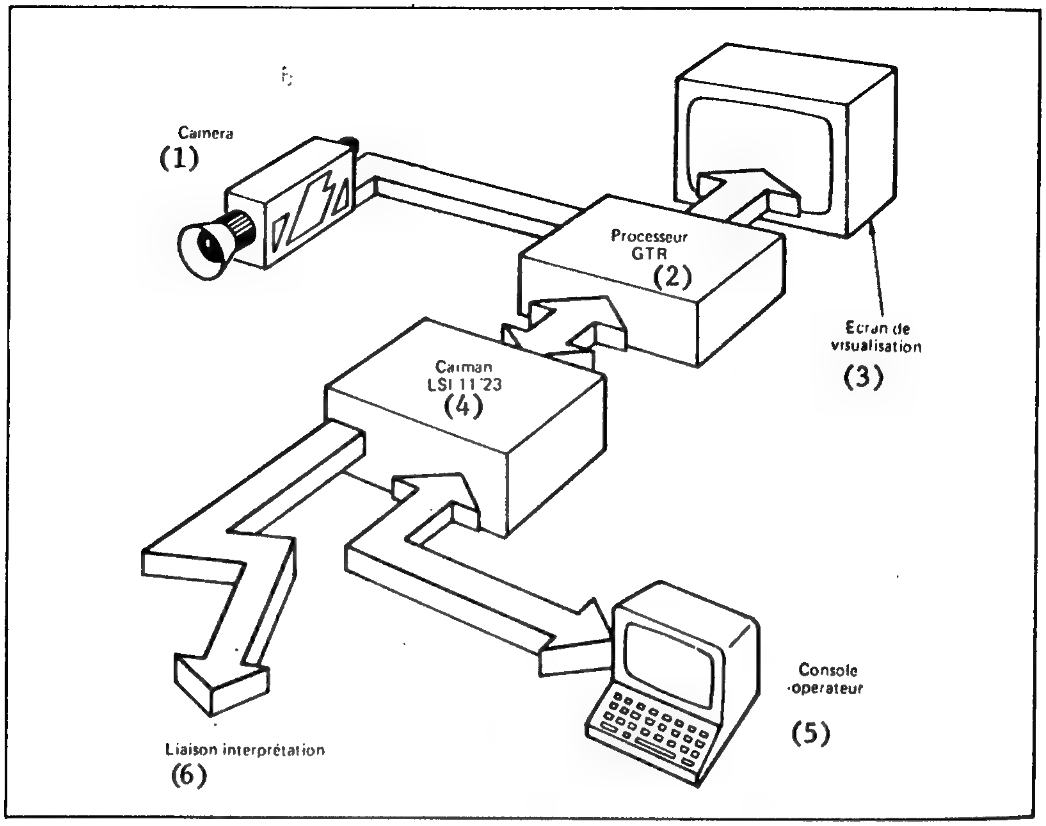

Figure 2. Physical Environment of the Caiman Software for the Analysis of Digitized Images

Key:
1. Camera
2. GTR processor
3. Display screen
4. Caiman LSI 11/23
5. Operator console
6. Interpretation link

(to restitute the actual 3-D coordinates of the points perceived in the image) and construction of 3-D profiles.

V3D has been used to monitor welded joints (joint depths). The system can be used to locate objects on a working place, inspect volumes, and as an aid to assembly and quality control.

Artificial Intelligence: A Common Denominator, ITMI

For Bruno Dufay, in charge of the artificial intelligence sector: "Although artificial intelligence is already 25 years old, it is a technology that is just entering the industry."

Bruno Dufay is working with Lisp and Prolog, depending on the problems he must solve: "Prolog is a declarative language developing a high-level logic. Lisp can then be considered as a low-level language with which you can write anything." In his opinion, the three languages of the future are Pascal, Lisp and Prolog, and no hierarchy should be established among them as all three complement one another.

ITMI and Hewlett-Packard

A contract signed a year ago with Hewlett-Packard in Grenoble just led to the installation of a control cabinet piloting a SCEMI robot in an automated production line, to insert components. The language supplied by ITMI with the cabinet is LM.

It is a high-level programming language containing primitives suitable for robot command. The objective of ITMI is for this language to become the standard, as it was designed to be used with all types of robots, contrary to the other two competing U.S. languages (Val of Unimation, and AML of IBM). These two languages are directly linked to the manufacturers, whereas ITMI is signing original-equipment-manufacturer contracts with Distribel (Belgian robots), GDA [expansion unknown] (German robots), SCEMI (French robots), MATRA [Mechanics, Aviation and Traction Company] Robots-Tronics, etc. Peugeot-Citroen, Renault, Digital Equipment and Hewlett-Packard are using LM, which will be sold in the United States in the same manner as GTR.

Who Is ITMI?

- A public company managed by a board (four founders), whose equity capital amounts to FF 1.375 billion.

- Chairman of the Board: Gerard Mezin.

- Date of creation: 1980.

- 1984 sales estimated at FF 8 million.

- Personnel: 25 (ITMI is looking for 5 computer engineers).

- Fields of operation: artificial intelligence, computer vision, robot control and programming.

- Address: ZIRST [Scientific and Technical Innovation and Development Park], Meylan (near Grenoble).

- Since recently, one subsidiary in Boston.

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SIEMENS' CAD SYSTEM DESIGNS VLSI CIRCUITS

Munich DATA REPORT in English Sep 1984 pp 18, 20-21

[Article by Berthold Koch and Martin Nett, Siemens AG, Corporate Laboratories for Information Technology, Munich: "CAD for IC's"]

[Excerpts] **The pace of development in the computer field is largely set by progress in semiconductor technology, which has led to the production of LSI and VLSI circuits. The ever-increasing complexity both of computers themselves and of the chips from which they are constructed means that it is essential to develop new design methods and production techniques to reduce development time and increase design reliability. New methods and tools are available to the system developer in the form of a VLSI-CAD system: the circuit design system VENUS® is used for the design and simulation of, and the preparation of test programs for, VLSI circuits.**

Computers develop VLSI circuits

Siemens has developed the CAD system VENUS for the design and simulation of VLSI circuits, enabling both gate array and cell design to be carried out. The computer thus enables development to be carried out right from logic diagram through to production documentation, automatically and over a very short time.

VENUS is used as the standard method within Siemens, and is also made available to external semiconductor customers and institutes of technology or colleges. VENUS runs on computers with operating system BS2000, and supports graphics terminals in addition to a CAD workstation. VENUS provides development engineers with the benefits of VSLI integration, and moreover, no special technological knowledge is required.

The developer will find it just as simple to use the gate arrays and cells which are offered to him in the form of a "catalog" as he did the familiar standard modules of the TTL series.

The development of chips using VENUS requires the involvement of the designer only during the logic design phase. All further stages are carried out by the CAD system largely automatically. Thus, VENUS is a complete design system in which CAD functions are integrated which allow easy, rapid, reliable conversion of a logic diagram into the production and test data for LSI circuits (Fig. 3).

Development using VENUS takes place in three successive steps:

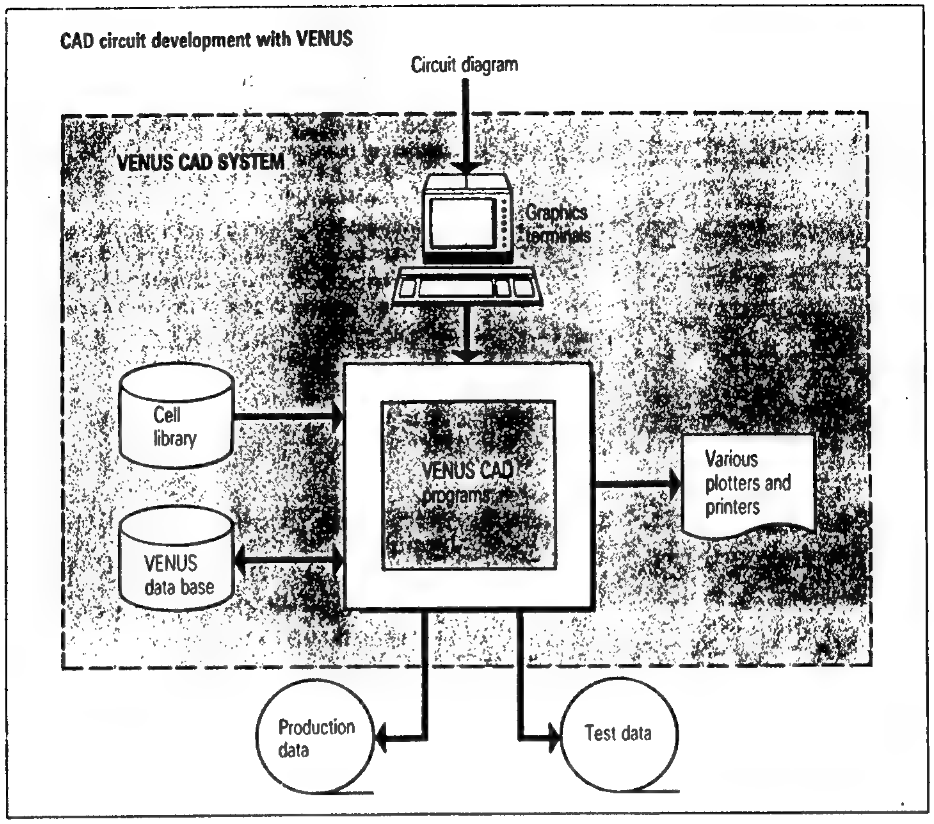

Fig. 3. The VENUS development system also enables non-specialists to design function blocks for VLSI chips

- Logic design
- Physical design and
- Generation of test and production data.

Logic design

The designer first of all generates the circuit diagram of the chip under development, based on the cell catalog in which each of the approximately 100 cells currently offered is described in terms of circuit symbols, function table, logic circuit, time characteristics and so on. VENUS helps the designer by providing menus at the graphics workstation.

The circuit diagram thus generated within the VENUS system is subjected to validity checks and stored in the central data base. Testing of the logic design is further assisted by simulation, during which the circuit model for logic simulation is automatically generated from the stored circuit diagram.

Physical design

A seamless interface leads directly on from logic circuit design through to the physical design of the chip.

This stage consists mainly of the placing of cells on the chip (Fig. 4) and interconnection (wiring) of the relevant cell pins based on the validated circuit diagram. Both operations run fully automatically under VENUS. Interactive intervention is possible, and is checked for permissibility on-line to ensure the overall reliability of the design.

The frame of the chip, with pads for power supply and signals, is also generated automatically.
A further advantage of the CAD system is the possibility of calculating the lengths of the line sections from the physical layout of the chip in order to accurately determine the signal delays and capacitances. This means that at a fairly early stage of development real-time simulation allows the reliability of the chip to be predicted.

Generation of Test and Production Data

In order to test the completed chip on an automatic tester, test bit patterns are taken from the logical verification, or in some cases derived from the structure and generated. They are then used as input data to a test program.
Geometric figures, automatically derived from the physical layout of the chip, are used to generate masks for the various stages of the subsequent chip manufacturing process.

The VENUS design system continues to develop

Currently under development in the Siemens research laboratories are so-called layout generators which enable the design engineer to generate layouts automatically from complex regular structures **(Fig. 5)** such as ROM, RAM or PLAs (programmable logic arrays). In addition to these regular structures, the designer will also be able, under certain marginal conditions, to design specific new cells himself, and with complete accuracy under the guidance of the CAD system.

Emphasis is also being placed on the development of a chip generator, which will be a hierarchical system of module and connection generators. It is designed to facilitate the creation of complex logic circuits, such as the ALU of a processor, so that automatic generation of such circuits becomes competitive with manual design, particularly in respect of chip area utilization.

[Photo captions] Fig. 4. This address comparison chip, about 25 mm^2 in area, shows the regular structure of standard cells generated during fully automatic design

Fig. 5. This experimental peripheral processor (16/8 bit) from Siemens' research laboratories is a step on the road to do-it-yourself VLSI design. The sections of the chip (programmable logic arrays) were developed using layout generators. The 110 mm^2 chip combines 300,000 transistors together with other regular structures (RAM, ROM)

The work on which this report is based was carried out with the financial assistance of the German Federal Ministry for Research and Technology (grant reference NT 2818/0).

CSO: 3698/179

THREE NETHERLANDS UNIVERSITIES PROPOSE VLSI SUPERCHIP PLANT

The Hague TNO PROJECT in Dutch Oct 84 p 420

/Article: "Delft 'Superchip' Plant Can Open in 2 Years. Plan for DASS /Delft Integrated Circuit and Sensor Plant/ Presented by the Three TH's /Universities of Technology/ Is Far Along"/

/Text/ The government would have to lay out 24 million guilders immediately and then another 3 million over a period of 4 years. If it does so, then DASS can open at the end of 1986. Delft TH's present integrated circuit manufacturing plant can then close down.

Delft TH's integrated circuit plant would be absorbed by the Netherlands' first (non-commercial) manufacturing plant for VLSI /very large-scale integration/ chips, chips with more than 10,000 components. If the plans go through, the "superchips" will indeed be "baked" in Delft, but it will be a national plant. The two other TH's, in Eindhoven and Enschede, joined Delft in presenting the DASS proposal to the government this summer.

The high costs of such plants are the principal reason the three TH's worked together. DASS, for instance, will require an investment of 34.9 million guilders. According to the proposal, the Ministry of Economic Affairs would have to contribute 16.6 million and the Ministry of Education and Sciences 7.3 million, a total of around 24 million guilders, more than two thirds of the set-up costs.

The government is still not through there, however. "One-time preliminary costs" amount to 500,000 guilders, which the two ministries ought to split fairly. The proposal from the three TH's estimates operational costs at 1.5 million guilders and salaries at 1.2 million a year. In the first 4 years the Ministry of Economic Affairs would contribute 300,000 guilders in each category, a total of 2.4 million more.

Experimental Plant

This national manufacturing plant for the most complex sensors (instruments that convert pressure or temperature, for instance, into an electronic signal) and circuits would serve industry at the same time. DASS would be able to make prototypes, manufacture short runs of integrated circuits and sensors or serve

as an experimental factory for Advanced Semiconductor Materials International (ASMI) in Bilthoven, one of the world's largest producers of manufacturing equipment for superchips and other chips.

The proposal submitted to the government paints the state of the country's industry in quite gloomy colors. "The rather wait-and-see attitude shown by businessmen and government threatens to make the Dutch businessman's competitive position rapidly worse." In smaller and middle-sized firms in particular, far too little is known about microelectronics in all its ramifications, according to the TH's.

Chips to Measure

The proposal estimates that there are some 30,000 manufacturing firms in the Netherlands. Some are involved in (micro)electronics, but most make other products. Around 10 percent are not specifically involved in (micro)electronics, just as the majority of firms are not, but could indeed use chips in their products.

The suggestion continues, "Today most product innovation occurs by adding information-processing components to an existing non-electronic device. This produces so-called 'intelligent' products, which are usually much easier to use. Examples are copying machines, scales, cash registers, organs, etc. If the 'intelligence' is added to the product in the form of standard integrated circuits mounted on printed-circuit cards, then it is quite impossible to protect the idea with a patent."

That is why Dutch firms buying integrated circuits on the open market could have a hard time of it: competitors can also buy integrated circuits and add them to products in the Far East, and there is frequently little or no protection against copying. Naturally things are different when a company has the necessary integrated circuits specially designed. "Chips to measure" (semi-custom or full custom integrated circuits) cannot be copied or can be copied only with extreme difficulty.

Basic Technology

Naturally DASS is not only to serve industry but also to play a key role in teaching a "highly essential basic technology." According to the proposal, "for a country to be incompetent in the field of microelectronics must be considered just as disastrous as for it to be incompetent in such fields as civil or mechanical engineering or architecture. There can be no doubt too that a developed country cannot permit itself to fall behind in the field of microelectronics."

That is why DASS is expected to double the number of "integrated circuit engineers" trained each year by Delft (around 30 at present). These engineers will not end up only in smaller and middle-sized firms, since our country also boasts one of the largest electronics giants in the world.

The proposal notes that, "after a somewhat slow start, Philips has now become one of the leaders in the microelectronics field. One of the biggest problems that Philips faces at present is that of attracting sufficient numbers of skilled engineers. For Philips the TH's play a key role."

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CSO: 3698/146

MICROELECTRONICS

NETHERLANDS PERSONNEL SHORTAGE THREATENS 'MEGAPROJECT'

Rotterdam NRC HANDELSBLAD in Dutch 12 Dec 84 p 9

[Article: "Personnel Shortage Threatens Chip Project. Professor Hooge at the Opening of Eindhoven TH's [University of Technology's] Chip Plant"]

[Text] Eindhoven, 12 Dec--"Philips did not plan the Megaproject well, and as a result the firm is never able to secure sufficient high-grade people in time. The manpower shortage forms a serious threat to the project's success."

Professor Dr. F. Hooge, professor of electrical engineering at Eindhoven TH, said this yesterday at the presentation of the Eindhoven integrated circuit manufacturing facility, the Department of Electrical Engineering's new chip plant. Hooge's colleague Professor Dr. Ing. J. Jess, also professor in the Department of Electrical Engineering, explained that it is probably possible to scrap parts of the Megaproject without threatening the entire operation. He underlined once more how important the Megaproject is for the Netherlands.

The Megaproject is a joint venture of Philips and Siemens to develop a submicron technology to further reduce the size of integrated circuits. The research will cost around 1.5 billion guilders over 5 years.

Of that sum, Philips and Siemens are each contributing 500 million, and the Dutch and German governments are paying the other half billion guilders. According to Professor Hooge, Philips alone will need more electrical engineers next year than the 300 that the three TH's together will graduate. Other firms too, such as the Post, Telegraph, Telephone, are hungry for electrical engineers. The Eindhoven professor predicted that this will create an insoluble problem for Dutch industry.

Abroad

Bringing experts from abroad will not work because there is a crying need elsewhere in Europe as well. According to Professor Hooge, the only thing that will help is if more young people study engineering, though any results from that would take years to come. His colleague, Professor Jess, calculated that even if the number of first year electrical engineering students doubled next year, there would not be enough engineers graduating from the TH's until after the Megaproject is long finished.

Professor Hooge said that Philips should have been working with the scientific institutions six years ago in order to try to get more young people interested in electrical engineering. "We have often complained to Philips about the lack of moral support." According to the Eindhoven professor, the firm seriously underestimated the need for engineers. "Philips thought things would not be so bad. In the past it was always a question of tens of people a year, and that never presented any difficulties. Now the demand is many times greater, while the labor market is noticeably tighter." Philips has already said that it will not be easy to get the necessary people. Still, the company sees no insuperable problems.

Specialities

A shortage of manpower can, according to Professor Jess, also act as a brake on plans to improve microelectronics teaching at the TH's. The Eindhoven professor said that on orders from the Ministry of Education and Sciences, outside experts have prepared a plan involving 140 million guilders over 3 years. The basic idea is for each of the TH's to develop two specialities, which would develop into so-called centers of excellence.

The TH's would also have the chance to further expand their small chip factories. According to Professor Jess, the plan states that the DASS project [Delft Integrated Circuit and Sensor Plant] should definitely be shelved. The outside experts conclude in their report that the DASS project, which would cost 35 million guilders, is far too ambitious. The Eindhoven professor said he expected that the resources available to stimulate microelectronics will now be distributed equally among the TH's.

2.7 Million

TH representatives spoke with the outside experts on 20 December about the final details of their plans. According to Professor Jess, the big question is whether the outside experts' proposals are not themselves too ambitious. He explained that acquiring sufficient personnel would present particular problems. He also had doubts about the financial feasibility of the plans.

Eindhoven TH's chip plant will start up officially at the beginning of January. Construction and outfitting cost 2.7 million guilders, of which 1.6 million guilders went just for equipment to keep the work area super-clean. The chip-manufacturing equipment cost another 500,000 guilders. The chip factory's primary function is to support instruction. Further, small and middle-sized firms will be able to acquire small quantities of chips from the Eindhoven manufacturing facility. Further, there is discussion about the possibility of also using the factory to train high-grade employees for Philips.

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CSO: 3698/146

FRENCH COMMENTARY ON SOVIET INDUSTRIAL ESPIONAGE

Paris LE NOUVEL ECONOMISTE in French 3 Dec 84 pp 60-65

[Article by Christian David and Jean Gloaguen: "Beware of Russian Spies"]

[Text] France continues to be the victim of intense industrial espionage whose targets have ranged from the Concorde supersonic transport to Cabasse high-fidelity speakers, from top-secret nuclear fusion research to the latest discoveries in underwater acoustics. The resultant losses undoubtedly run into tens of billions of francs. Alarmed by these losses, the government has initiated a major program to track down the smugglers.

This is a most difficult task, however, as recently demonstrated, involuntarily, by the CISI, the Atomic Energy Commission's (CEA) computer science and data processing subsidiary. The CANARD ENCHAINE has revealed that with a simple Minitel and access rights to a data bank, it is possible to gain access to classified data stored by the CEA or other CISI customers--Thomson and Matra, for example--working on sensitive projects. Even though the most secret nuclear and largely military research data are not stored on CISI disks, the CANARD ENCHAINE's disclosures do show that the scenario of the motion picture "War Games" was not mere science fiction. In that film, a teen-age computer whiz electronically breaks into a computer at the Strategic Air Command Headquarters. Obviously, the big question is: Who can possibly benefit from such pirating activity?

All evidence points to the Soviet Union which is responsible for 70 percent of the technological espionage in France, according to officials of the DST (Directorate of Territorial Surveillance). The Soviet Union has established a vast tentacular information-collection network whose sole function is to search out Western technology. This gigantic effort enables the Soviets to close their high-technology gap and, according to some estimates, save between 25 and 50 billion dollars a year. Even though this spy network's priority objective is to strengthen the Red Army, neutralizing it requires extending protective measures to cover much more than the activities of defense contractors.

The fact is that in France, as everywhere else in the West, most of the technologies and equipment incorporated into weapon systems are also used in civilian goods available on the open market. Furthermore, as a result of industrial specialization and subcontracting, hundreds, and at times thousands of firms can be involved in the production of certain weapons systems.

Hence to protect ourselves against the Soviets, we also need to protect ourselves against Western competitors. These defensive measures are still centered, however, primarily within the area of the East-West confrontation. French authorities believe French firms are big enough to defend themselves against the Japanese and other oriental copying specialists.

Enough is enough. So on 5 April 1983, a few weeks before his trip to Moscow, Francois Mitterrand expelled 47 Soviet diplomats based in Paris, 42 of whom belonged to the KGB and five to the GRU, the Red Army's intelligence service. This was a clean sweep designed to show that France would no longer be a country where nothing can be kept secret. The Soviet delegation in France had grown from 200 to 800 persons in the 1970's. And at least one-third of them were engaged in spying.

This French counterattack had been preceded by a tightening of security surrounding "national defense secrets and information" and also "national scientific and technical resources in international exchanges and trade." In addition, the secret list of laboratories (some 100) and plants (approximately 400) working on sophisticated projects was revised and expanded. Admission of foreign trainees into these facilities became more selective. In 1983, there were 250 Soviet and 350 Polish trainees compared with 350 and 450 respectively in 1982.

At the same time, maximum publicity was given to arrests of Frenchmen "working for a foreign power". The most spectacular arrest was that of Pierre Bourdiol in November 1983. A billiant Aerospatiale engineer, Bourdiol had worked on the Ariane European launcher program and likewise on intercontinental ballistic missile projects. Firms like Renault, Matra, and Thomson have become more sensitive to espionage risks and created special security departments with broad powers.

These coordinated security measures reflect the growing public awareness of the fact that the Soviet Union is using France, and indeed all Western countries, as its technological data bank. At the core of this Soviet industrial espionage system is the VPK (Commission for Military Industry). This agency is to the Red Army what the well-known MITI [Ministry of International Trade and Industry] is to Japanese industry. Under the direction of Leonid Smirnov, one of the deputy chairmen of the USSR Council of Ministers, the VPK receives requests from the 12 ministries concerned with armament matters and distributes these requests in the form of acquisition requirements among five institutions: the KGB and GRU, of course, but also the Academy of Science, the GKNT (State Committee for Science and Technology), and the Ministry of Foreign Trade (see section entitled "Soviet Industrial Espionage System" near the end of this article). In addition, the intelligence agencies of the satellite countries also respond to Soviet collection tasking and provide their input to the VPK. An expert told us: "The Soviet Union is interested in practically everything that happens in Western laboratories and plants: status of major defense programs, configuration of latest electronic circuits, plans for nuclear power plants, as well as rail traffic control systems, latest discoveries in neurochemistry, and airport organization. Industrial espionage is a means of saving time and money for a country which allocates 15 percent of its wealth to defense expenditures. Above all, this form of espionage is a reflection of the inefficiency of the Soviet

system which, although capable of great achievements in space, cannot keep pace with Western innovation in such vital technologies as electronics, computers and data processing, telecommunications, and medicines.

As befits its eminent position in the world, the United States, and especially Silicon Valley with its booming hi-tech electronics firms, is the prime target of a systematic Soviet espionage effort. Another special target is West Germany where some 10,000 East bloc spies are reported to be operating. Their recruitment is naturally facilitated by the presence of refugees from the German Democratic Republic who have remained loyal to their country of origin, as demonstrated once again by the recent arrest of Manfred Rotsch, a 60-year old Messerschmitt engineer who had worked on production of the Tornado interdiction/ strike aircraft.

And what about France? General de Bary, head of the National Defense General Secretariat (SGDN), revealed in an interview given the magazine LA RECHERCHE that "completely identifiable technology transfers have occurred in such areas as underwater acoustics, fiber optics, and lasers." There have also been leaks of information on highly classified nuclear fusion research.

Soviet targets in France actually constitute the best listing of those fields of activity in which France ranks among the world's leaders. The list naturally includes such direct defense activities as aircraft, armored vehicles, missiles, munitions, and nuclear weapons. The "threatened" firms engaged in these activities are readily identifiable: Atomic Energy Commission, Aerospatiale, Dassault, Thomson, Matra, etc.

In contrast, listing firms working with advanced technologies that have civilian as well as military uses is more complicated because of the large number of such technologies. These include microelectronics: material, components, circuit design and manufacturing machinery; optoelectronics: infrared devices, lasers, and imaging technology; electronics applied to telecommunications, detection, guidance, and countermeasures; data processing: computers, networking, software, cryptography; robotics and automation: artificial intelligence, voice recognition, numerical control; materials: composites, ceramics; biology: genetic engineering, immunology; directed energy: high-energy lasers, particle beam; chemistry: solid fuels, radiation absorbing coatings; oceanographic and geophysical equipment; etc. The following should also be added to this impressive list: plans of nuclear power plants, large turnkey manufacturing plants, major civil engineering projects, and the latest advances in food production technology.

With its 1,700 employees (including secretaries), the DST does not have sufficient manpower to cover all fronts. Hence its counterespionage sleuths endeavor primarily to indoctrinate the business community through lectures and conferences in which they disclose the subterfuges used by spies and furnish advice on appropriate security measures.

The subterfuges? Suspense and mystery novel enthusiasts are quite familiar with them. First, it must be realized that technology pirates can be of different types. They include, of course, intelligence officers who are usually fluent in French and have had high-level scientific or technical training. When these agents operate under diplomatic cover within their country's embassy or trade mission in Paris, they are well-known to the DST.

When the officers have been admitted into France as political refugees, spotting them is a far more complicated task. This is likewise the case with the "moles," in other words nationals who work for another power. Outwardly there is no reason to suspect these men who act this way either out of political conviction, or for money, or most frequently because they have been trapped into an embarrassing position making them susceptible to blackmail (cherchez la femme!).

In any case, judges of the Special No Jury Court, which replaced the defunct State Security Court, do not go easy on unmasked "moles". On 14 November, they sentenced Patrick Guerrier, a young librarian at the French Coal Board's research center, to 5 years in prison for having passed a copy of a confidential report printed in 500 copies to a Soviet agent.

Other "carriers" include visitors and trainees. Who knows what the Soviet and Chinese delegations carried back to their countries after their visit to the International Electronics Equipment and Products Show (PRONIC) held in Paris from 20 to 23 November? Some 15 years ago, Soviet aircraft manufacturers visiting southwestern France were unusually interested in the Messier foundry in Bidosse. One of their French escorts remembers how "eagerly they sought information on formulas for making light alloys for the landing gear of their Tupolev transport, the botched copy of the French-British supersonic transport.

Very special precautions are taken with foreign trainees. By definition, the purpose of their stay in France is to learn as much as they can in a specific field. This does not mean they are all spies. The SGDN reviews 10 percent (approximately 2,000) of the applications for training. This screening did not prevent Poland from building a creditable tire industry thanks to the training its judiciously selected engineers and technicians received in European tire manufacturing plants.

A foreign trainee's assigned target frequently does not correspond exactly with the officially stated reason for his presence. For example, a trainee will be found in the room used for assembling a military sighting system instead of the optics laboratory where he is authorized to be. The Chinese are past masters at this type of subterfuge. The chief of security in a major electronics firm told us: "When you count them, there's always one missing."

There is an infinite variety of methods of acquiring information. These include: searching wastebaskets, reading documents left on desks during the lunch break, collecting old computer tapes, clandestine photography, and telephone "bugs". The most commonplace methods are not necessarily the least effective. Said a former military officer: "On the TGV [very high-speed train] and Air Inter lines, the chit-chat of engineers and executives is a veritable gold mine for anyone choosing to listen. Passengers can also be seen working on 'Defense Secret' documents." Young French engineers working in communist countries should beware of their sudden and irresistable seductive powers.

In plain language, comprehensive protection of sensitive facilities, access badges, television surveillance, and patrolling security guards are useless if persons fail to take a few basic precautions. Confidentiality begins with such measures as destruction of superseded or out-of-date documents, surveillance of data-processing facilities, keeping plans, studies, and analyses in locked security cabinets, and shielding data on display screens from visitors' view.

Prior to the recent tightening of security safeguards, such confidentiality had not by far been achieved. In early 1982, a reporter for LE NOUVEL OBSERVATEUR was hired as a night watchman, without any prior security background investigation, at Matra's Velizy plant where he was able to saunter freely through the executive offices, the main computer area, and missile-launcher assembly buildings. In early September 1983, a person taking a walk in Paris' 20th arrondissement found a copy of a 350-page report prepared by Aerospatiale on the nuclear-armed M-4 missile. Some 2 months later, microcomputers for Dassault's Mirage 2000 aircraft, plans for an ultramodern radar and a new artillery shell were stolen from a vehicle.

Yet firms working for the military services do indeed assume certain security obligations. National defense contracts call for establishment and maintenance of secure areas, security clearances for employees and trainees, document classification, handling, and distribution procedures, etc.

In laboratories, design offices, and plants working on civilian projects, the naivete and easygoing attitude of employees are often overwhelming. To have a paper of theirs published in a prestigious periodical or to be applauded by their peers at a conference or symposium, scientists will unhesitatingly reveal discoveries that can quickly be converted into industrial applications. How, for instance, should we view those French telephone manufacturers who, a few weeks ago, obligingly disassembled their latest small automatic switch so that Japanese visitors could photograph the device's inner workings? While curbing the illegal acquisition of know-how and documents depends primarily on the preventive measures taken by industrial firms, the DST is the front-line agency responsible for preventing the communist world from smuggling high technology equipment on the export control list. This list is compiled by CoCom (Coordinating Committee for Multilateral Export Controls), an agency established during the cold war. Headquartered in Paris, its membership consists of the NATO countries, France and Japan. In addition to weapon systems, the CoCom list includes semiconducters and high technology electronic equipment. When Eastern bloc countries cannot import equipment legally they try to procure it by devious ways. For example, they have purchased tons of pinball machines, electronic games and dolls merely to obtain the microprocessors therein. But as a computer expert explained: "They did not even have to use this scheme because the last word in chips can be bought in specialty stores (on the 'grey market') and then shipped home via diplomatic pouch."

A large computer or electronic telephone exchange cannot be acquired or transported so easily. The trick in such cases is to funnel the equipment through an intricate labyrinth of dummy companies, changing the destination on the manifest each time it is reshipped. A recent example was the seizure of two large Digital Equipment Corp. computers in Helsingborg, Sweden. Their ultimate destination was the Soviet Union. In the same vein, a few months ago the Swedes returned some integrated circuit production equipment to Thomson, its manufacturer, who had sold it initially to a Guernsey import-export firm that had assured Thomson it was for a customer in Great Britain.

Safeguarding national secrets and enforcing export controls are goals difficult to achieve, especially as it frequently is not necessary to use illegal means to obtain certain types of information. Espionage is said to play but a small

part--10 percent--in the acquisition of scientific and technical intelligence by Soviet bloc countries. The other 90 percent comes from open sources, namely from newspaper articles, documentation on products offered by manufacturers and distributors, books, and data banks freely available to the public. Each issue of the American magazine AVIATION WEEK & SPACE TECHNOLOGY is reportedly forwarded to Moscow by the first available aircraft and translated into Russian en route. Even though France is not the United States, we can be sure that the 20,500 Soviet students taking intensive courses in our language will not necessarily end up as teachers or tourist guides.

Security and trade do not always make good bedfellows. In 1983, Western sales to the Soviet Union amounted to 26 billion dollars and provided employment for approximately a million persons. Naturally, therefore, such sales have their supporters. CoCom is a continuous illustration of this fact. After the period of detente in the 1970's, the United States began trying to revitalize that coordinating committee. Close associates of President Reagan, led by Richard Perle, assistant secretary of Defense for international security policy, became advocates of measures to technologically throttle the Soviet Union. It is appropriate, in this connection, to recall at this point some of France's past acts of complaisance: the CII's [International Data Processing Company] sale of a printed circuit manufacturing plant to the Soviet Union in the mid-1970's, and the installation of a large data processing system for the Tass news agency a short time later.

Some 6 months after the crackdown on the Solidarity labor union in Poland, President Reagan tried unsuccessfully to convince his allies at the Versailles economic summit not to help build a natural gas pipeline from Siberia to Europe. He then demanded a thorough revision of the CoCom lists to make them more restrictive. But the United States gradually eased its demands in these negotiations which ended on 12 July 1984. In so doing, was the United States prompted by a desire to avoid a clash with its allies? Or did it have a guilty conscience about contributing to Soviet power by its grain sales agreement? Or doubts about the effectiveness of embargoes? Or was it influenced by pressure from a large segment of the U.S. business community supported by the Department of Commerce? In all likelihood, each of these four reasons were contributing factors.

France likewise has to deal tactfully with conflicting interests in its relations with the Soviet Union. On the diplomatic level, President Mitterrand has constantly and openly shown his distrust of Moscow (which is still rankled by the French president's speech on Euromissiles to German lawmakers). But the Soviets are making him pay for this by no longer signing practically any large contracts: 600 million francs this year compared with 1.3 billion francs in 1982 and 5 billion in 1981. Yet, pursuant to the agreement signed in 1982, the French Gas Company's purchases of Soviet natural gas are increasing. As a result, France's trade deficit with the Soviet Union is rising at such a brisk rate that it is expected to reach the 10-billion franc mark by 1986.

Industrial espionage thus ties in with the major problems associated with the ratio of opposing political, economic, and military forces. Because of this, the danger is that we may drift into over-simplification or laxity.

Over-simplification? The confusion between obtaining classified information and the capacity to exploit it. A recent NATO report noted: "Europe's economic weaknesses are not due to a lack of scientific and technical resources but to a certain incapacity for transforming technical knowledge into technological innovations. The same diagnosis is applicable to the Soviet production system.

Laxity? The recurrent character of periods of tension and detente in East-West relations plus the impossibility of indisputably measuring the dividends from increased security could lead us to lower our guard.

As always, the interested parties--researchers and managers--are in the best position to find the happy medium between laissez faire and obsession. Today they want more secrecy and security.

When a Country Depends on America for Technology

Three of every four high technology products are made outside the United States, but their manufacture depends largely on American technology. In France, for example, the semiconductor industry rests largely on U.S. "second source" agreements, Thomson with Motorola, Matra with Harris and Intel.

The United States thus has formidable means of exerting pressure on its allies. When, for example, Thomson wanted to sell its RITA (Integrated Automatic Telecommunications System) to the U.S. Army, it had to be prepared to make a few concessions. Admittedly the stakes were high, namely $4 billion.

The United States has a redoubtable weapon in its Export Administration Act (EAA) which dates back to 1969 and was amended in 1979. The U.S. Congress is to consider rewriting it once again in January 1985. The EAA contains an extraterritoriality clause that infuriates Europeans. Subsidiaries of American firms or foreign companies with American licenses must obey U.S. export laws when they reexport U.S. advanced technologies. Failure to do so makes violators liable to legal action, fines, and breach of contract. Under this clause, Cruesot-Loire Company and Dresser Industries' French subsidiary were barred from receiving "products, services, and technology."

The days when Washington viewed France as not being a "reliable" country have long past, but with the "increased technological sensitivity", measures taken by the United States became dramatic. In 1981, the U.S. Government banned the sale of its high-powered Cray computer system to France. Bull inherited the order and is now developing the Isis computer, France's first supercomputer.

To render pressures inoperative, the most simple thing to do is try to check the flow of technology and, if possible, bring it in balance.

France has already had some successful achievements in this regard. Ada, the U.S. Department of Defense's computer programming language, was designed by a French team. NATO is expected to decide before 1986 whether to adopt Ada as its language.

But the most conspicuous example of this new French determination is the development of a national computer data encoding system. Between the transmission of data via the telephone system and the radiations emitted by computers, a clever amateur can manage to conduct some highly profitable computer pirating or espionage operations.

Hence the absolute need to encode. IBM has a monopoly with its DES (Data Encryptation System), the only one available on the market. French authorities have decided not to use it, but instead to finance development of their own system. Thomson is now working on this system jointly with military experts, the PTT [Postal and Telecommunications Administration] and the TDF [French Radio and Television Broadcasting Agency]. The Coding Department is expected to be able to give the system its official approval sometime in 1985.

Soviet Industrial Espionage System

VPK

The VPK, Commission for Military Industry, is responsible for: coordination of intelligence operations, definition of targets, preparation of missions, and operational decisions. It receives requests from the 12 ministries concerned with armament matters and distributes these requests in the form of acquisition requirements among the five institutions described below: Academy of Science, GNKT, KGB, GRU, and Ministry of Foreign Trade.

Academy of Science

This institution is directly under the Council of Ministers. It is responsible for orientation and development of basic research.

GNKT

The GNKT, State Committee for Science and Technology, ranks as a ministry. It is responsible for: scientific and technological development, exploitation of information, signing cooperation agreements, and linkage of basic research with its industrial application.

KGB

The KGB, Committee for State Security, is responsible for internal and external security. It has some 500,000 agents, half of whom are in foreign countries. Its four general directorates are under the authority of the Politburo and the Council of Ministers. Its First General Directorate is responsible for operations in foreign countries and hence for "line-x", in other words scientific and technological intelligence.

GRU

The GRU, Chief Intelligence Directorate, is attached to the Ministry of Defense. It is responsible for collecting scientific and technological information having military applications. It is organized into operational sections.

Ministry of Foreign Trade

This ministry is responsible for: planning and control of foreign trade, and formulation of policy for the purchase of technologies.

French Counterespionage Agencies

SGDN

The SGDN, National Defense General Secretariat, is attached directly to the Office of the Prime Minister. It is responsible for: coordination of all agencies--including the four described below--charged with protection of the defense establishment's scientific and technological resources; and for direction of the work of the Defense Scientific Action Committee and the Interministerial Intelligence Committee.

DST

The DST, Directorate of Territorial Surveillance, is a Ministry of Interior directorate. It is responsible for detection and neutralization of foreign activities inimical to the country's security, integration and exploitation of intelligence on espionage activities, and participation in the protection of key points and key sectors of national activity.

DPS

The DPS, Directorate of Protection and Security, is a Ministry of Defense directorate formerly known as the Military Security Service. It is responsible for: protection and security of sensitive personnel, information, material, and installations; and preparation and implementation of protective and security measures.

PSI

The PSI, Industrial Protection and Security Service, is subject to the direction and control of the Ministry of Defense's General Delegation for Armament. It is responsible for: furnishing technical advice on the protection of firms working for the defense establishment or in sensitive industrial sectors; and supervising implementation of protective measures.

DSPS

The DSPS, Directorate for Security and Protection of Secrecy, is an Atomic Energy Commission (CEA) directorate attached to the CEA's Directorate for Military Affairs. It is responsible for the protection and security of personnel, installations, and industrial processes within the nuclear sector.

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